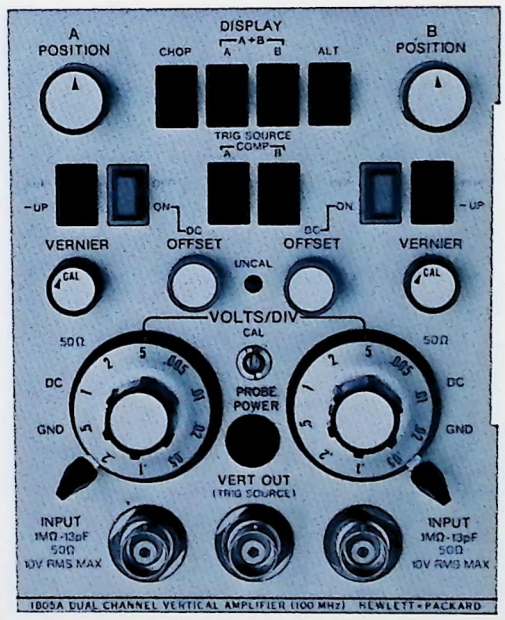
HP 1805A

OPERATING AND SERVICE MANUAL

DUAL CHANNEL VERTICAL AMPLIFIER

1805A



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HP 1805A

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

MODEL 1805A
DUAL CHANNEL VERTICAL AMPLIFIER

SERIALS PREFIXED: 1233A

Refer to Section VII for instruments with other Serial Prefixes.

HEWLETT-PACKARD COMPANY/COLORADO SPRINGS DIVISION
1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

Manual Part Number 01805-90901
Microfiche Part Number 01805-90801

PRINTED: SEPT 1972

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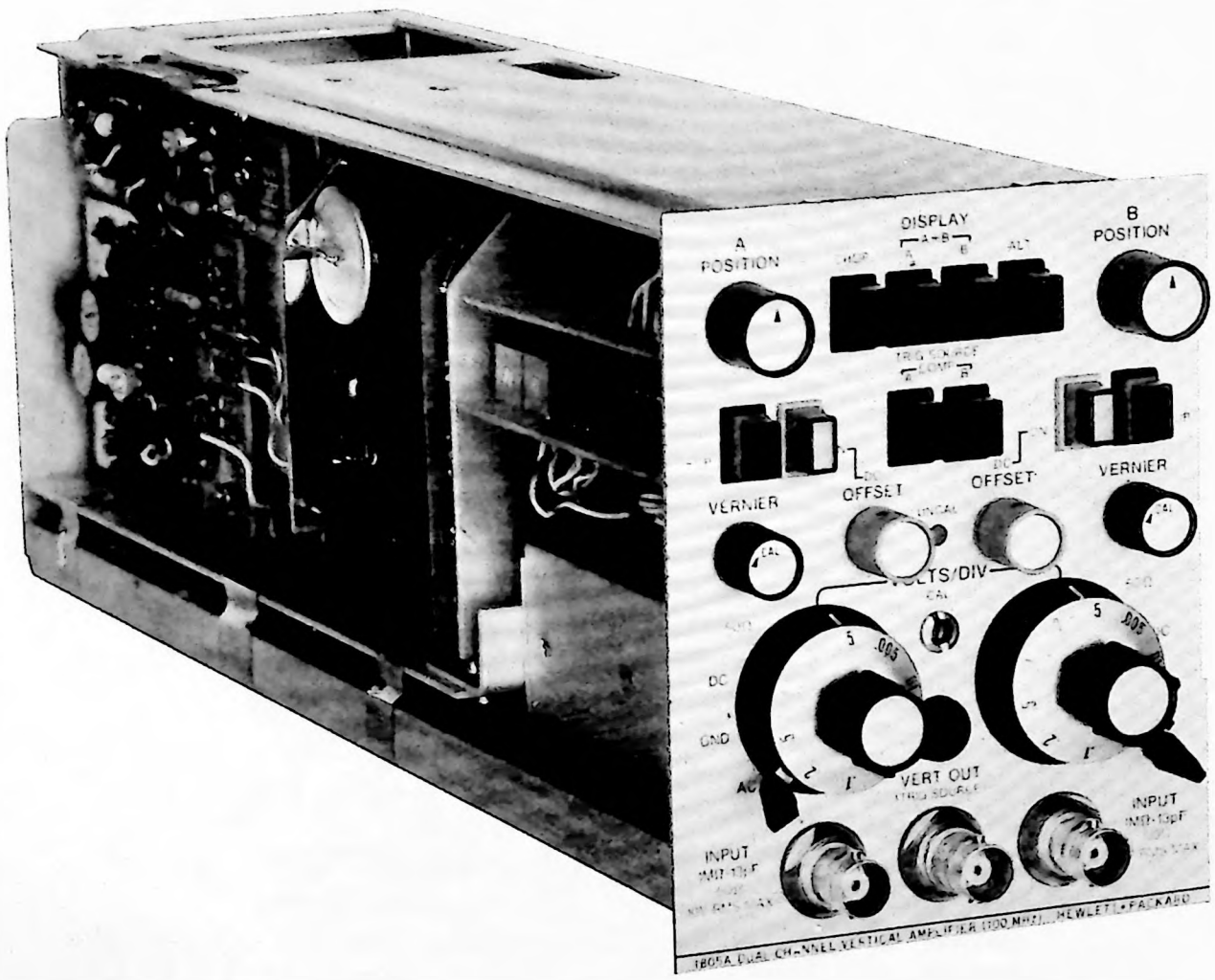

1805A-R-9

Figure 1-1. Model 1805A Dual Channel Vertical Amplifier

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and servicing information for the Hewlett-Packard Model 1805A Dual Channel Vertical Amplifier (figure 1-1). The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section contains a description of the Model 1805A. The instrument specifications are listed in table 1-1. Table 1-2 lists and describes the abbreviations used in this manual except Section VI. The parts list is a computer readout and uses computer-supplied abbreviations.

1-4. DESCRIPTION.

1-5. The Hewlett-Packard Model 1805A 100-MHz plug-in is a dual-channel vertical amplifier designed to operate in conjunction with a horizontal time base plug-in in the 180-series oscilloscope mainframe. Each channel of the Model 1805A has a bandwidth of 100 MHz and a selectable input impedance of either 1 megohm, shunted by approximately 13 pF, or 50 ohms ± 1%.

1-6. Model 1805A can accurately display two input signals individually, alternately, simultaneously or in an algebraically added mode. A choice of a positive or a negative polarity display of either channel A or channel B is provided. The displays may be synchronized to the channel A signal or the composite of the input signals.

1-7. Each channel has 10 calibrated deflection factors, ranging from 5 mV/div to 5 V/div in a 1, 2, 5 sequence.

1-8. WARRANTY.

1-9. The warranty statement applicable to this instrument is printed inside the front cover of this manual.

CAUTION

The warranty may be void for instruments having a mutilated serial number tag.

1-10. ACCESSORIES FURNISHED.

1-11. Two 10:1 voltage divider probes, HP Part No. 10004C, are furnished with the Model 1805A.

1-12. INSTRUMENT AND MANUAL IDENTIFICATION.

1-13. This manual applies directly to Model 1805A instruments with a serial prefix number as listed on the manual title page. The serial prefix number is the first group of digits in the instrument serial number (figure 1-2). The instrument serial number is on a tag located on the rear panel.

1-14. Check the serial prefix number of the instrument. If the serial prefix number is different from that listed on the title page of this manual, refer to Section VII for instructions to adapt this manual for proper instrument coverage.

1-15. Errors in the manual are listed under errata on an enclosed MANUAL CHANGES sheet (if any).

1-16. INQUIRIES.

1-17. Refer any questions regarding the manual, the change sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a world-wide listing of HP Sales/Service Offices.

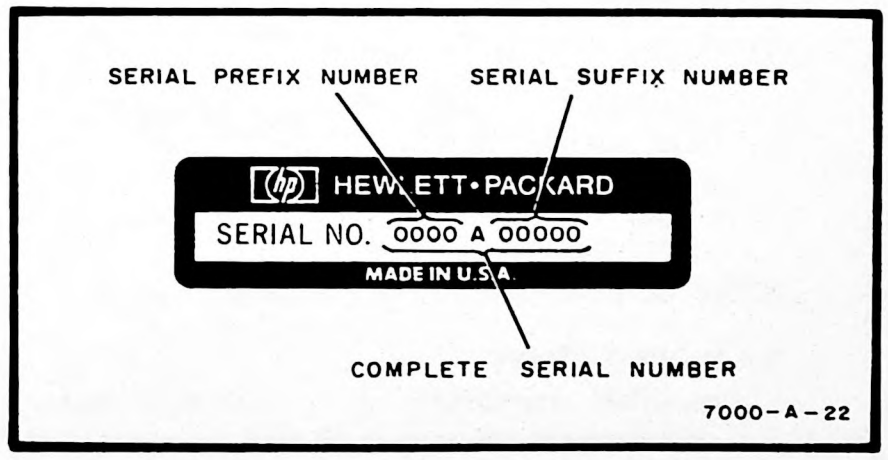

Figure 1-2. Instrument Serial Number

Table 1-1. Specifications

MODES OF OPERATION

channel A; channel B; channels A and B displayed alternately on successive sweeps (ALT); channels A and B displayed by switching between channels at 400-kHz rate (CHOP); channel A plus channel B (algebraic addition).

VERTICAL AMPLIFIER

BANDWIDTH: 3 dB down from 8-division reference signal, measured, with or without probe HP 10004C, from terminated 50-ohm source.
DC coupled: dc to 100 MHz.
AC coupled: approximately 10 Hz to 100 MHz; lower limit approximately 1 Hz with probe HP 10004C.

RISETIME: < 3.5 ns 10% to 90% with 6-division input step from terminated 50-ohm source. Measured with or without probe HP 10004C.

DEFLECTION FACTOR: 5 mV/div to 5 V/div (10 calibrated positions) 1, 2, 5 sequence.
Accuracy: ±2%.
Vernier: continuous adjustment between deflection factor ranges. Extends maximum deflection factor to at least 12.5 V/div. UNCAL indicator lights when vernier not in CAL position.

POLARITY: +UP or —UP selectable.

SIGNAL DELAY: signals are delayed to view leading edge of pulse without advance trigger.

INPUT COUPLING: selectable AC, DC, GND or 50 ohms. GND position disconnects signal and grounds amplifier input.

INPUT RC
AC-DC: 1 megohm ±1% shunted by approximately 13 pF, constant on all ranges.
50 ohm: 50 ohms ±1%.

VSWR <1.35:1 at 100 MHz on 5 mV/div range and < 1.1:1 at 100 MHz on all other ranges.

MAXIMUM INPUT
AC-DC: ±300V (dc + peak ac) at 1 kHz or less.
±150V (dc + peak ac) on 5 mV/div range at 1 kHz or less.
50 ohm: 10V rms.

DYNAMIC RANGE: 6 divisions for on-screen displays at 100 MHz, increasing to 16 divisions at 15 MHz.

POSITIONING RANGE: 16 divisions.

A + B OPERATION
Amplifier: bandwidth and deflection factors unchanged; either channel may be inverted for ±A ±B operation.
Differential Input (A-B) common mode: cmr is at least 40 dB from dc to 1 MHz for common-mode signals of 16 divisions or less. Cmr at least 20 dB at 100 MHz for common-mode signals of 6 divisions or less.

TRIGGERING

SOURCE: channel A, channel B, or a composite (COMP) A & B in any display mode. Composite is channels A and B signals switched for ALT and CHOP modes and added for A + B mode. Vernier and position controls do not affect A, B, or COMP trigger signals. A and B trigger signals are also independent of polarity selections.

FREQUENCY

Time Base plug-in	Trigger Frequency (except chop)	Required Vertical Deflection
1820C 1824A-1825A 1840A, 1841A	 dc to 50 MHz dc to 100 MHz	 0.5 div 1 div
1820B, 1822B	dc to 50 MHz dc to 100 MHz	0.5 div 2 div
1820A, 1821A	dc to 50 MHz	1 div

DC OFFSET

±200 divisions for offsetting dc signals or ac signals within specified dynamic range and maximum input.

VERTICAL OUTPUT (Selected by Trigger Source)

BANDWIDTH: > 80 MHz into 50 ohms.

AMPLITUDE: > 50 mV/div of displayed signal into 50 ohms with usable amplitudes up to 500 mV p-p.

SOURCE IMPEDANCE: approximately 50 ohms.

WEIGHT

net, 5 lb (2, 3 kg); shipping, 8 lb (3,6 kg).

ENVIRONMENT

(plug-in operates within specifications over following ranges.) Temperature 0°C to +55°C; Humidity 95% at 40°C; Altitude to 15000 ft; Vibration, vibrated in three planes for 15 minutes each with 0.010-inch excursion 10 to 55 Hz.

Table 1-2. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc. electrical part	P	= plug	U	= integrated circuit (unrepairable)
AT	= attenuator, resistive termination	F	= fuse	PS	= power supply	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor, fan	FL	= filter	Q	= transistor	VR	= voltage regulator (diode)
BT	= battery	H	= hardware	R	= resistor	W	= cable
C	= capacitor	J	= Jack	RT	= thermistor	X	= socket
CP	= coupling	K	= relay	S	= switch	Y	= crystal
CR	= diode	L	= inductor	T	= transformer	Z	= network
DL	= delay line	LS	= speaker	TB	= terminal board		
DS	= device signaling (lamp)	M	= meter	TP	= test point		
		MP	= mechanical part				

ABBREVIATIONS

A	= ampere(s)	FET	= field-effect transistor(s)	n	= nano (10^{-9})	rfi	= radio frequency interference
ampl	= amplifier(s)			nc	= normally closed		
assy	= assembly			no.	= normally open	rms	= root mean square
ampltd	= amplitude			npn	= negative-positive-negative	rwv	= reverse working voltage
		G	= giga (10^{9})				
bd	= board(s)	gnd	= ground(ed)	ns	= nanosecond		
bp	= bandpass					SCR	= silicon controlled rectifier
		H	= henry(ies)				
c	= centi (10^{-2})	hr	= hour(s)	p	= pico (10^{-12})	sec	= second(s)
C	= carbon	HP	= Hewlett-Packard	pc	= printed (etched) circuit(s)	std	= standard
ccw	= counterclockwise	Hz	= hertz				
coax.	= coaxial			pk	= peak	trmr	= trimmer
coef	= coefficient	if.	= intermediate freq.	pnp	= positive-negative-positive		
com	= common	intl	= internal			u	= micro (10^{-6})
CRT	= cathode-ray tube			p/o	= part of	usec	= microsecond
cw	= clockwise	k	= kilo (10^{3})	p-p	= peak-to-peak		
				prgm	= program	V	= volts
d	= deci (10^{-1})	lb	= pound(s)	prv	= peak inverse voltage(s)	var	= variable
dB	= decibel	lpf	= low-pass filter(s)				
				ps	= picosecond	w/	= with
ext	= external	m	= milli (10^{-3})	pwv	= peak working voltage	w/o	= without
		M	= mega (10^{6})			wiv	= working inverse voltage
F	= farad(s)	ms	= millisecond	rf	= radio frequency		

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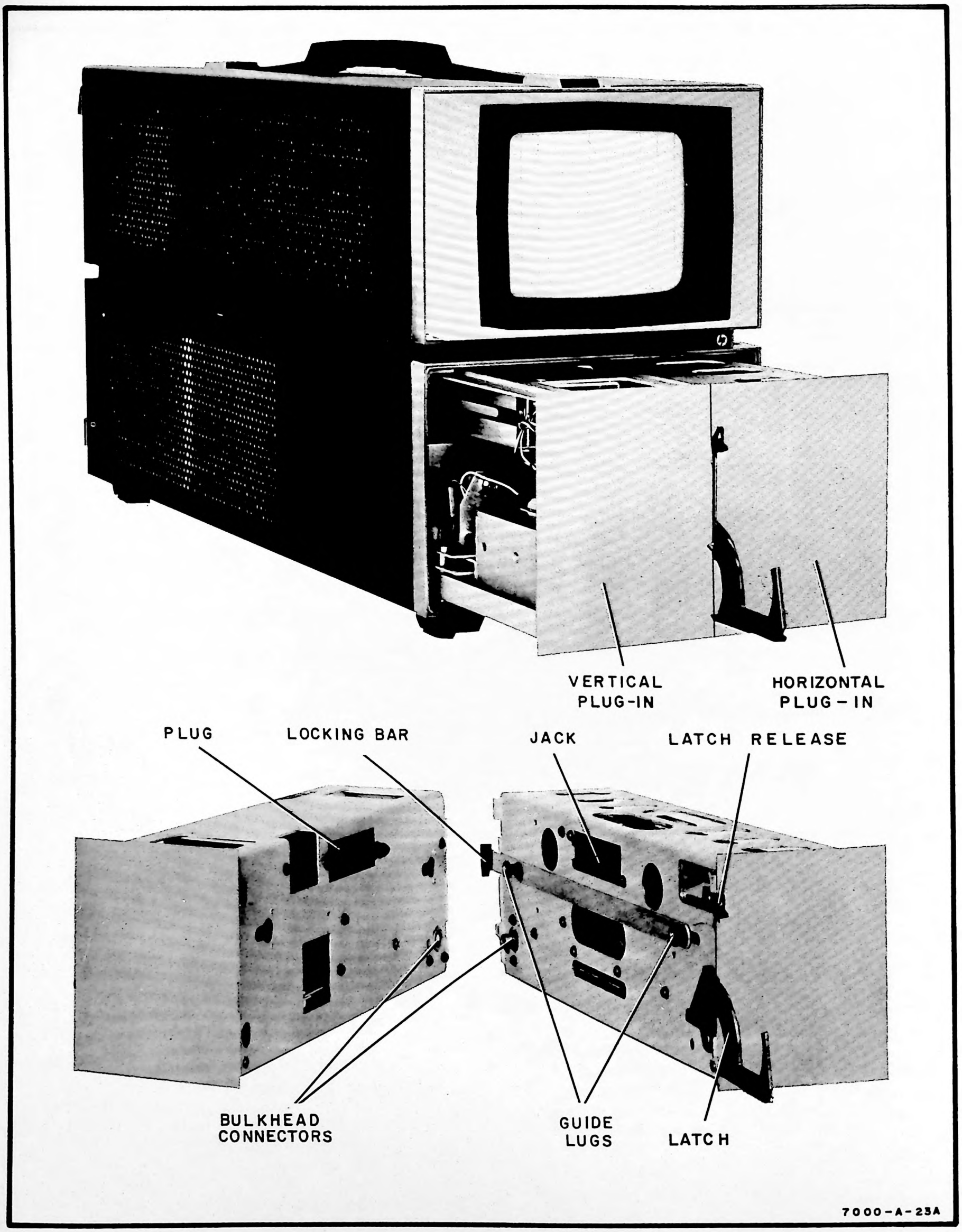


Figure 2-1. Plug-in Mating

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of the Model 1805A. Installation procedures and precautions are presented in step-by-step order. The procedures for making a claim for warranty repairs and for repacking the instrument for shipment are also described in this section.

2-3. INITIAL INSPECTION.

2-4. The instrument was inspected mechanically and electrically before shipment. Upon receipt, inspect it for damage that may have occurred in transit. Check for broken knobs, bent or broken connectors, and dents or scratches. If damage is found, refer to the claims paragraph in this section. Retain the packing material for possible future use.

2-5. Check the electrical performance of the instrument immediately after receipt. Refer to Section V for the performance check procedure. The performance check will determine whether or not the instrument is operating within the specifications listed in table 1-1. Initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to the claims paragraph in this section.

2-6. PREPARATION FOR USE.

2-7. The Model 1805A and horizontal plug-in must be locked together before installing into a 180-series oscilloscope mainframe. This procedure is explained below. Power for the Model 1805A is supplied by the oscilloscope through the horizontal plug-in.

Note

To adapt Model 1805A to time bases Model 1840A serial prefix 1123A and below and Model 1841A serial prefix 1150A and below; order modification kit HP part number 01840-69503 for Model 1840A and modification kit HP part number 01841-69506 for Model 1841A.

2-8. Install plug-ins as follows:

a. Move locking bar to rear (figure 2-1).

b. Fit plug into jack, making certain bulkhead connectors and guide lugs are aligned, and press plug-ins firmly together.

c. After ensuring that front and rear panels are aligned, push locking bar forward.

d. Lift up on latch release and rotate latch downward. Insert plug-ins into oscilloscope.

e. Rotate latch upward and push forward to lock.

2-9. CLAIMS.

2-10. The warranty statement applicable to this instrument is printed inside the front cover of this manual. If physical damage is found or if operation is not as specified when the instrument is received, notify the carrier and nearest Hewlett-Packard Sales/Service Office immediately (refer to the list in back of this manual for addresses). The HP Sales/Service Office will arrange for repair or replacement without waiting for settlement of the claim with the carrier.

2-11. REPACKING FOR SHIPMENT.

2-12. If the Model 1805A is to be shipped to a Hewlett-Packard Sales/Service Office for service or repair, attach a tag showing owner (with address), complete instrument serial number, and a description of the service required.

2-13. Use the original shipping carton and packing material. If the original packing material is not available, the HP Sales/Service Office will provide information and recommendations on materials to be used. Materials used for shipping an instrument normally include the following:

a. A double-walled carton; refer to table 2-1 for test strength required.

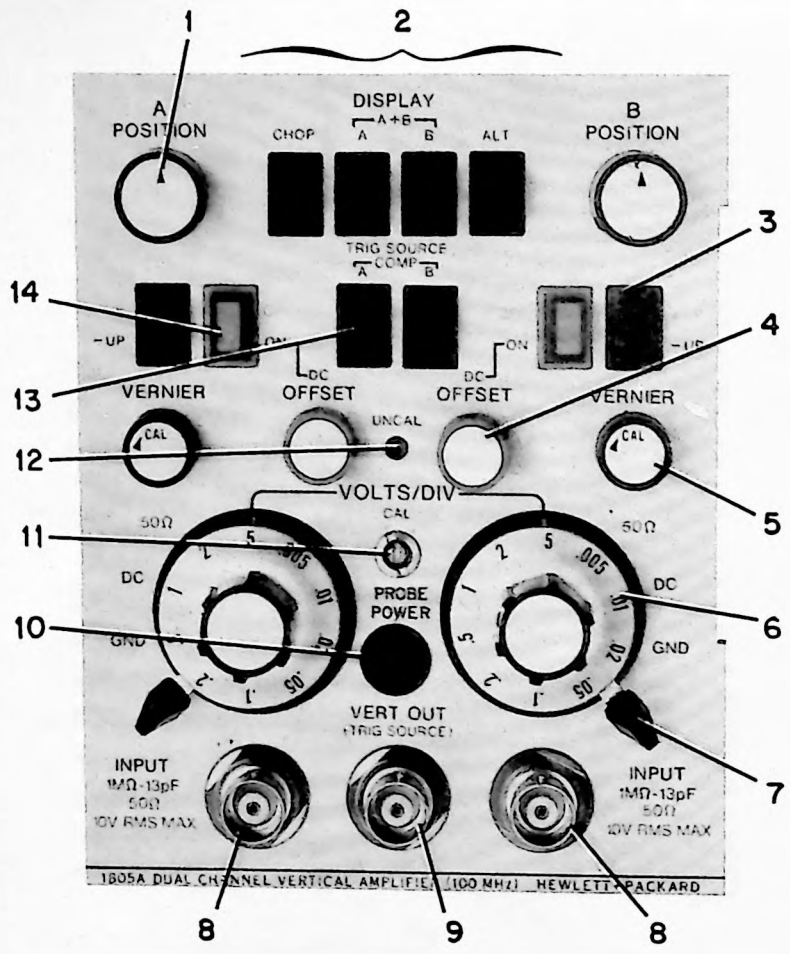
b. Heavy paper or sheets of cardboard to protect all instrument surfaces; use a nonabrasive material such as polyurethane or cushioned paper such as Kimpak around all projecting parts.

c. At least 4 inches of tightly-packed, industry-approved, shock-absorbing material such as extra-firm polurethane foam.

d. Heavy-duty shipping tape for securing outside of carton.

Table 2-1. Shipping Carton Test Strength

Gross Weight (lb)	Carton Test Strength (lb)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600



1. POSITION. Potentiometer changes trace position on vertical plane of CRT (functions same in channel A or B).

2. DISPLAY. Pushbutton switches allow selection of display presented: CHOP, channel A, channel B, ALT, or channels A + B.

3. polarity. Pushbutton switch selects normal display (+UP) or inverted display (—UP).

4. DC OFFSET. Potentiometer controls amount of dc voltage applied to null out unwanted dc signal at input.

5. VERNIER. Potentiometer with switch detent adjusts sensitivity between ranges selected on TIME/DIV switch.

6. VOLTS/DIV. Rotary switch selects vertical deflection factor for calibrated measurements (functions same in channel A or B).

7. coupling. Lever switch selects 50-ohm input impedance, direct coupling, capacitive coupling, or grounds amplifier input and disconnects signal.

8. INPUT. BNC connector for application of signal to be displayed (functions same in channel A or B).

9. VERT OUT. BNC connector supplies inverted signal corresponding to setting of TRIG SOURCE; A, B, or COMP.

10. PROBE POWER. Three-pin connector supplies operating power for accessories such as active probes.

11. CAL. Screwdriver adjustment corrects amplifier gains to VOLTS/DIV setting when changing from one mainframe to another.

12. UNCAL. Indicator lamp lights when VERNIERS are out of calibrated detent.

13. TRIG SOURCE. Pushbutton switches select channel A, channel B, or composite of channels A and B.

14. dc offset OFF-ON. Pushbutton switch connects or disconnects dc offset voltage.

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Figure 3-1. Controls and Connectors

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section contains an explanation of instrument operating controls, available modes of operation, and step-by-step operating instructions for most applications.

3-3. CONTROLS AND CONNECTORS.

3-4. Figure 3-1 shows the instrument front panel and provides functional descriptions of the operating controls, indicators, and connectors. Where the controls for channel A and B are identical, only those for channel A are described. The following paragraphs provide detailed descriptions of controls with multiple or complex functions.

3-5. DISPLAY.

3-6. These four pushbutton switches select the type of display presented on the CRT. Input signals can be displayed singly or simultaneously from both channels as explained below:

3-7. CHOP position presents a separate display of each input. Both inputs are displayed during the same sweep by switching between each channel at a rate of 400 kHz. This mode should be used to display low frequency signals.

3-8. Position A displays the channel A input signal.

3-9. Position B displays the channel B input signal.

3-10. ALT position presents two separate displays, one for each channel input signal. The display alternates between channels. This mode should be used to display high frequency signals.

3-11. A + B position provides a single display that is the algebraic sum of both channels. The polarity of each channel determines whether the display is the sum or difference of the input amplitudes.

3-12. OFFSET VOLTAGE.

3-13. The offset voltage function provides a method of measuring ac voltages superimposed on dc, by nulling out the dc voltage.

Note

The offset function should not be used to view small details on top of a large ac signal.

3-14. The dc offset OFF—ON pushbutton connects or disconnects the dc offset voltage.

3-15. DC OFFSET controls the amount of dc voltage applied to null out the dc signal at the input.

3-16. TRIG SOURCE.

3-17. These pushbutton switches select the signal source to be used for generating a trigger in the horizontal sweep circuitry and also determine the signal (channel A, channel B, or composite of channels A and B) that is available at the VERT OUT connector.

3-18. Position A selects channel A as the horizontal trigger source and VERT OUT signal.

3-19. Position B selects channel B as the horizontal trigger source and VERT OUT signal.

3-20. COMP position is with both A and B pushbuttons pressed. This position furnishes a signal that is the composite of channels A and B.

3-21. COUPLING.

3-22. The front panel coupling switch performs two functions. It selects the input impedance and the type of input coupling. The AC and DC positions provide a high impedance input and the 50 Ω position provides a dc-coupled, 50-ohm input impedance.

3-23. The AC position provides capacitive input coupling from the INPUT connector to the preamplifier. This permits viewing ac waveforms having high dc levels that would normally drive the display off screen with dc-coupled input.

3-24. GND position disconnects the INPUT connector from the preamplifier and grounds the input signal. GND position provides a method of establishing a reference without disconnecting the input.

3-25. The DC position provides direct coupling from the INPUT connector to the preamplifier. This position permits viewing long-duration, low frequency pulses.

3-26. The 50 Ω position provides a dc-coupled, 50-ohm input impedance to the preamplifier from the INPUT connector. This switch position provides a low VSWR to high frequency, 50-ohm input signals.

3-27. INPUT PROBES.

3-28. Two HP Model 10004C 10:1 divider probes are supplied with each Model 1805A and should be used whenever possible to reduce loading the circuit under test.

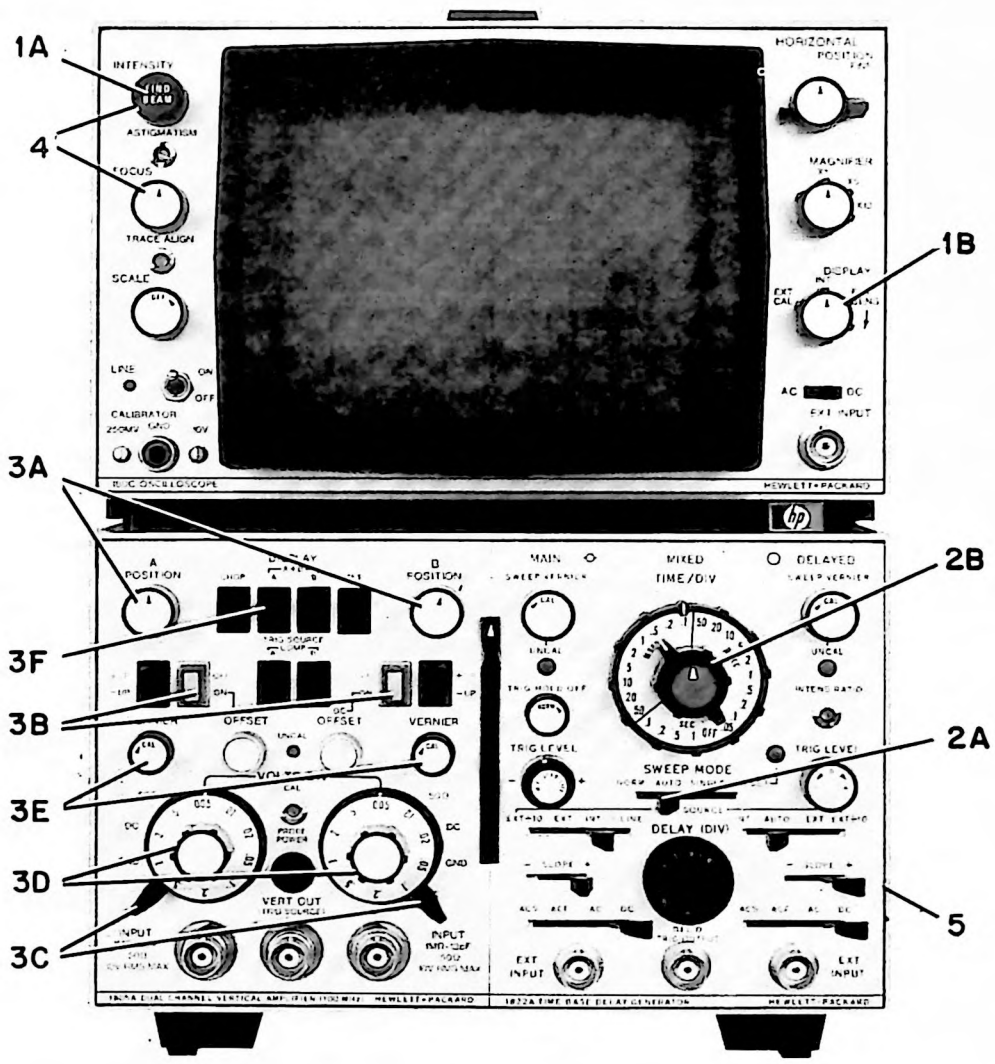
3-29. APPLICATIONS.

3-30. Dual input impedance capabilities combined with dual-channel, 100-MHz bandwidth provide accurate measurements and troubleshooting applications of both digital and analog circuits. The Model 1805A is ideal for logic measurements and comparisons for TTL, ECL, and MOS type logic circuits.

3-31. Time-related measurements can be displayed by selecting a trigger source from either channel A or B, or the composite of channels A and B. This allows triggering on either channel while viewing the time relationship with the other channel. In composite triggering, each channel is individually triggered.

3-32. OPERATING PROCEDURES.

3-33. Figures 3-2 through 3-8 contain step-by-step operating procedures. The index numbers on the photographs correspond to step numbers in the procedures. Only the basic operating techniques are explained in the procedures. Most of these can be modified or combined to fulfill a wide variety of unique requirements.



1. Set mainframe controls as follows:

   a. intensity . . . . . maximum ccw

   b. display . . . . . internal

2. Set time base controls as follows:

   a. sweep mode . . . . . automatic

   b. time/division . . . . . 0.2 ns

3. Set Model 1805A (both channel A and B when applicable) as follows:

   a. POSITION . . . . . midrange

   b. dc offset OFF-ON . . . . . OFF

   c. coupling . . . . . GND

   d. VOLTS/DIV 2

   e. VERNIER . . . . . CAL

   f. DISPLAY . . . . . A

4. Apply power to oscilloscope and adjust intensity and focus for sharp and just visible trace.

5. Adjust time base for stable sweep.

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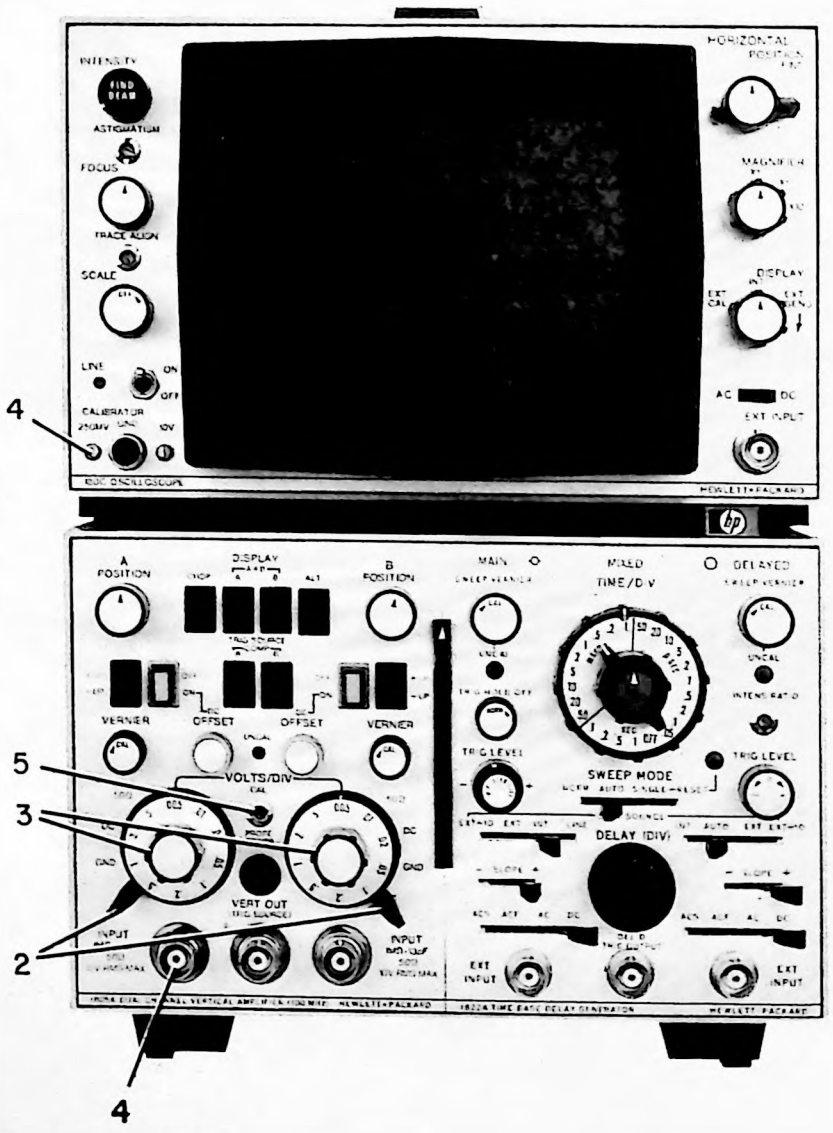
Figure 3-2. Initial Turn-on Procedure



1. Perform initial turn-on procedure (figure 3-2).
2. Set channel A and B coupling to AC.
3. Set channel A and B VOLTS/DIV to .05.
4. Connect 250-mV calibrator signal to channel A INPUT.
5. Adjust CAL for 5-division display.

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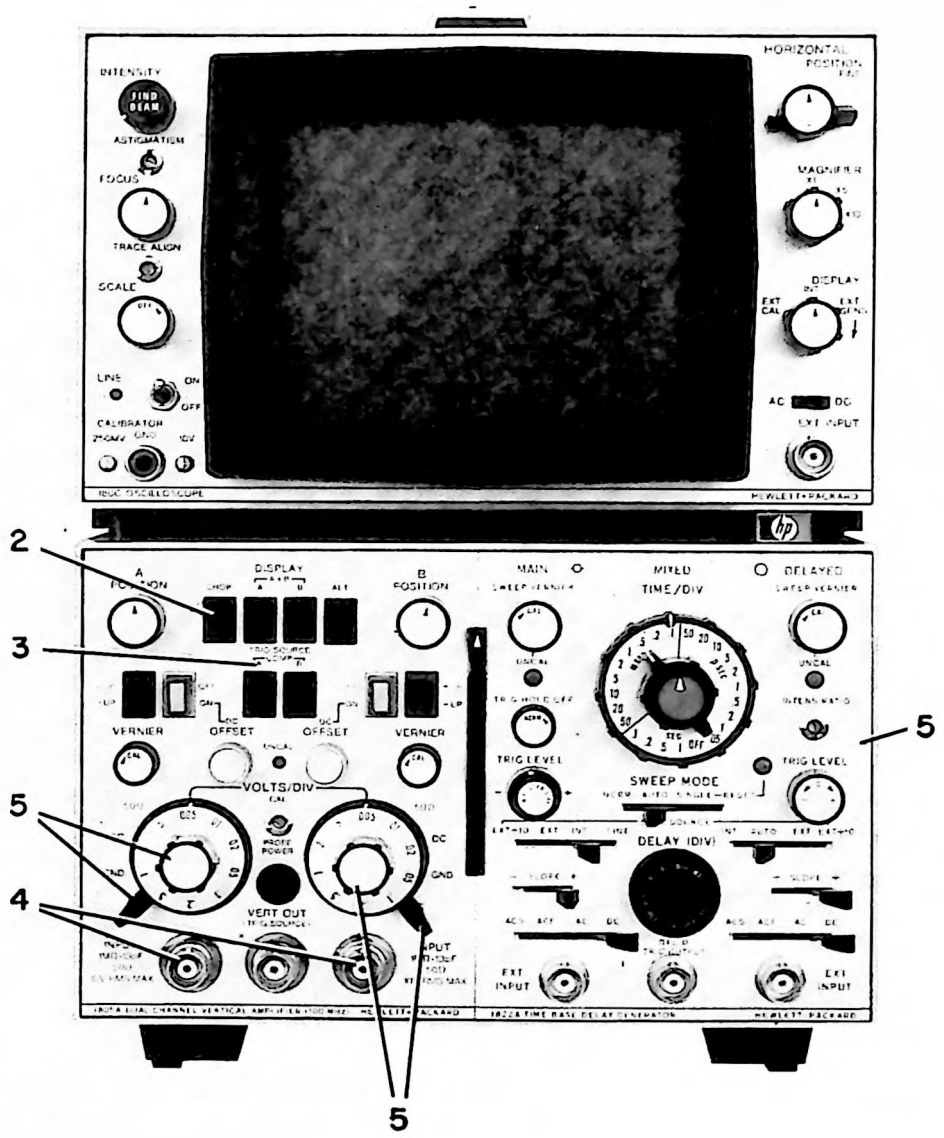
Figure 3-3. Amplifier Calibration



1. Perform initial turn-on procedure (figure 3-2).
2. Set DISPLAY to CHOP.
3. Set TRIG SOURCE to A and B.

Note

During CHOP operation, two signals can be viewed simultaneously on a time-sharing basis. CHOP mode is recommended for sweep speeds of less than 1 millisecond/division.

4. Apply signals to channel A and B INPUTS.
5. Set coupling, VOLTS/DIV, and time base controls as required.

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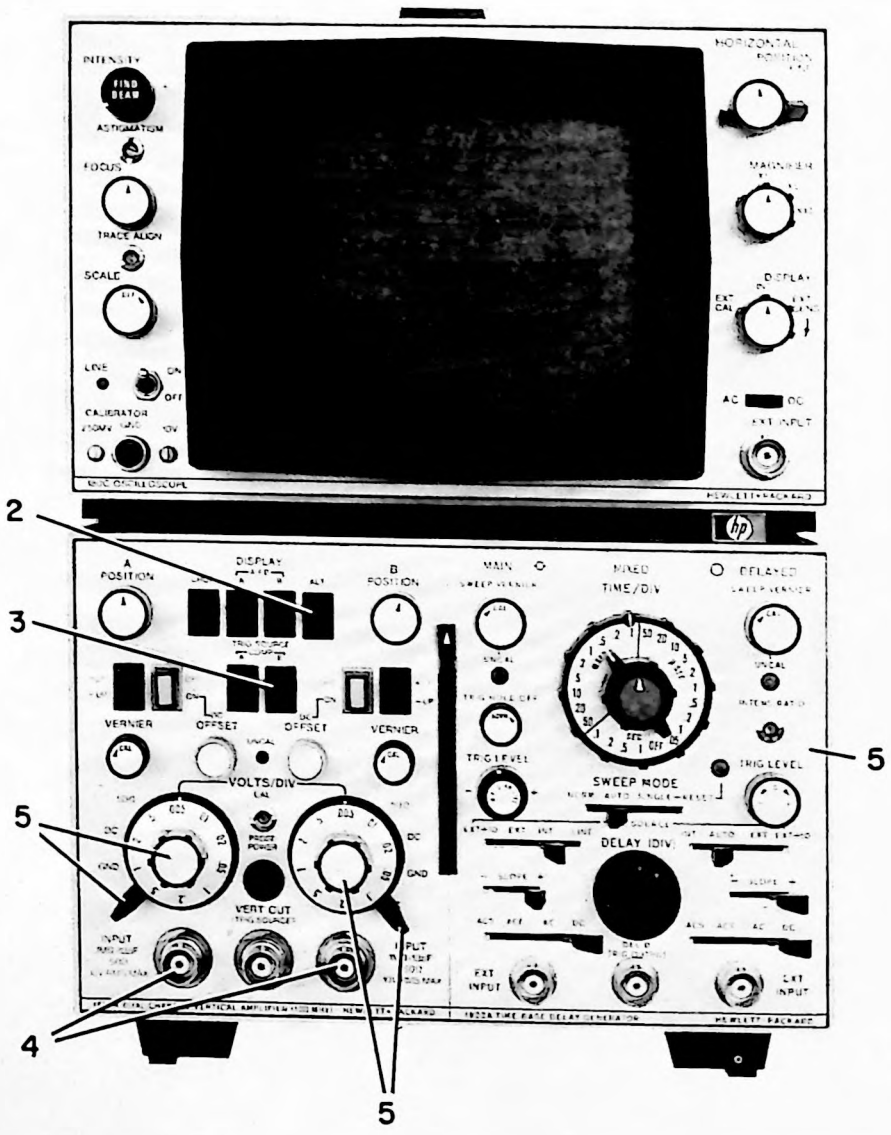
Figure 3-4. CHOP Mode Operation



1. Perform initial turn-on procedure (figure 3-2).
2. Set DISPLAY to ALT.
3. Set TRIG SOURCE to A, B, or COMP, depending on triggering requirements.

Note

During ALT operation, two signals can be viewed simultaneously. Trace alternates between channels on each sweep. ALT mode is recommended for sweep speeds greater than 1 millisecond/division.

4. Apply signals to channel A and B INPUTS.
5. Set coupling, VOLTS/DIV, and time base controls as required.

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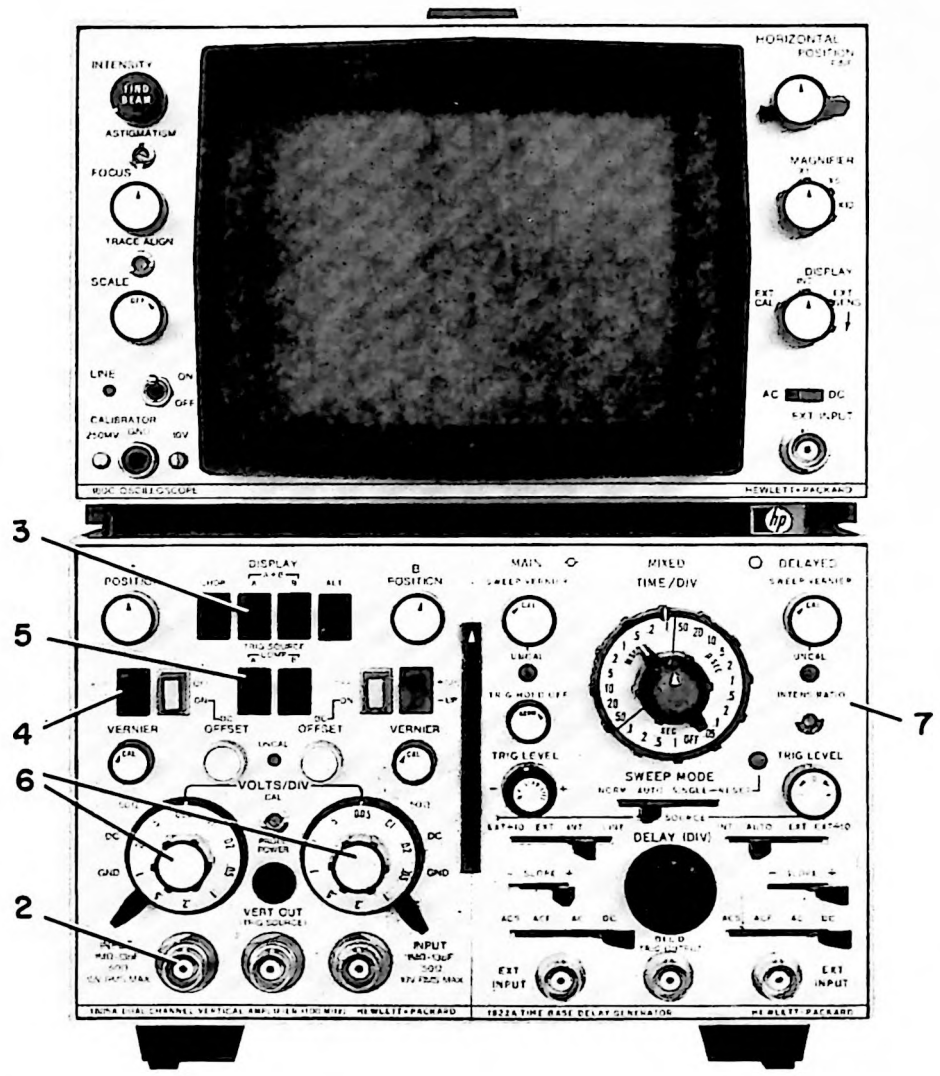
Figure 3-5. ALT Mode Operation



1. Perform initial turn-on procedure (figure 3-2).
2. Connect signal to channel A INPUT.
3. Set DISPLAY to A.
4. Set channel A polarity to +UP.
5. Set TRIG SOURCE to A.
6. Set channel A and B VOLTS/DIV to .05.
7. Set time base controls as required.
8. For channel B operation, change steps 2, 3, 4, and 5 to B.

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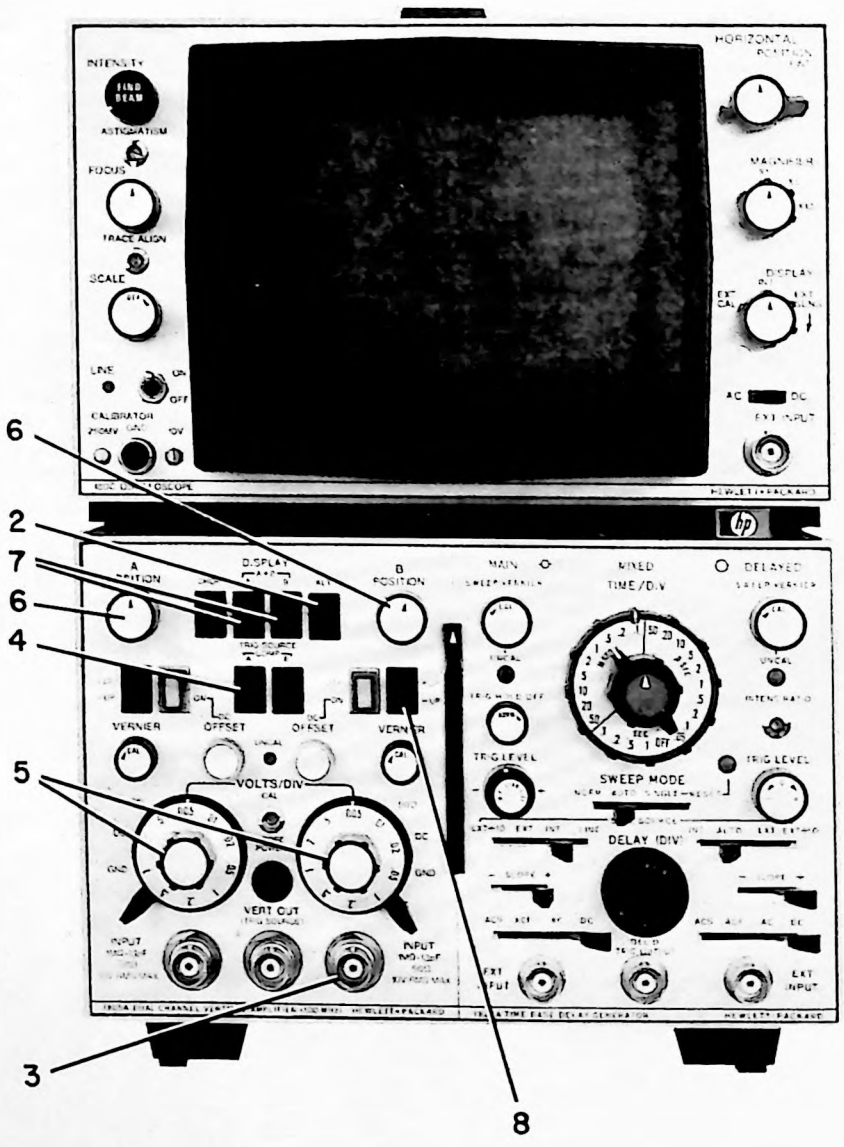
Figure 3-6. Single Channel Operation



1. Perform initial turn-on procedure (figure 3-2).
2. Set DISPLAY to ALT.
3. Connect signals to channel A and B INPUT.
4. Set TRIG SOURCE to A, B, or COMP as desired.
5. Set VOLTS/DIV A and B as desired.
6. Position traces to approximately center screen.
7. Set DISPLAY to A + B.
8. For A – B operation, set channel B polarity to –UP.

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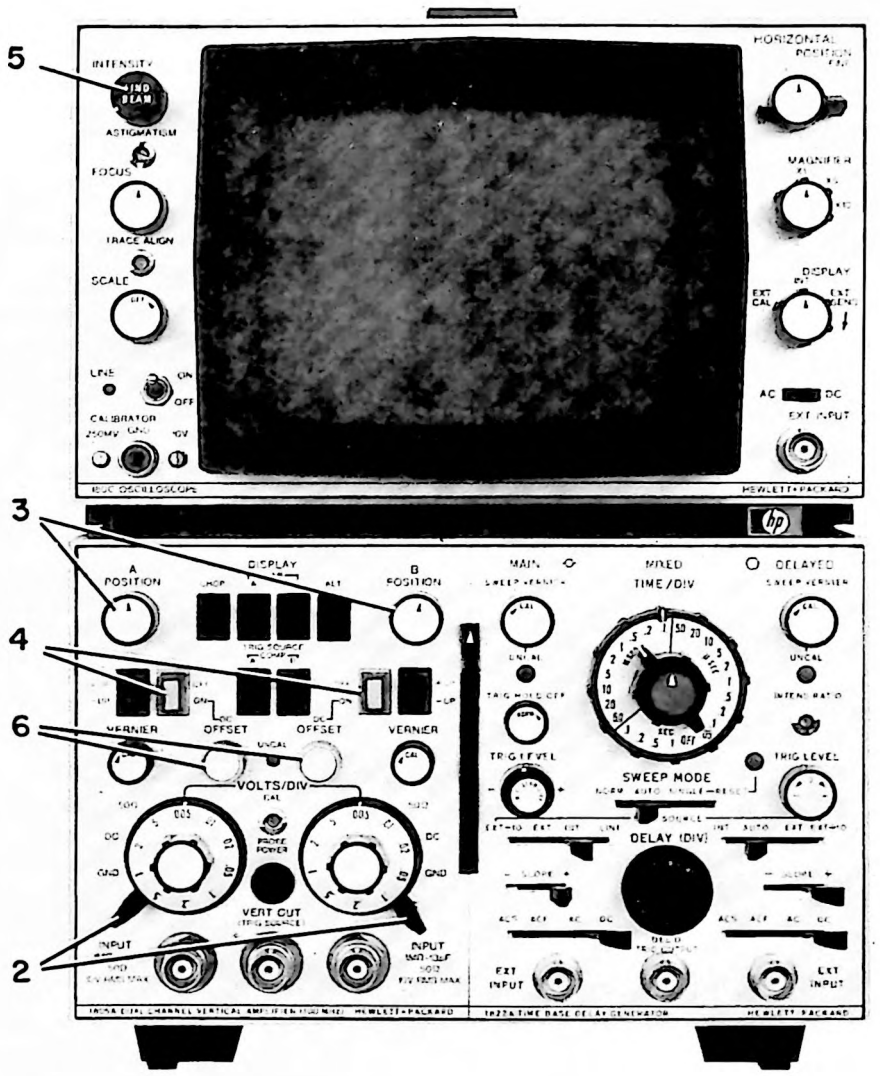
Figure 3-7. A + B and A – B Operation



1. Perform initial turn-on procedure (figure 3-2).
2. Set coupling A and B to DC.
3. Set POSITION A and B to midrange.
4. Set dc offset OFF—ON to ON.
5. Press mainframe find beam to locate trace.
6. Adjust OFFSET control to center trace.

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Figure 3-8. DC Offset Voltage Operation

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides the theory of operation for the Model 1805A. A block diagram discussion is first, followed by a detailed circuit description. The block diagram discussion is keyed to the trouble-shooting block diagram located in Section VIII. The detailed circuit description is keyed to the schematics in Section VIII.

4-3. BLOCK DIAGRAM.

4-4. Because operation of channels A and B are identical, the following text is applicable to either vertical channel.

4-5. ATTENUATOR.

4-6. The attenuators are compensated voltage-divider types with selectable input impedance of either 1 megohm, shunted by approximately 13 pF, or 50 ohms ±1%. The 10 calibrated positions, ranging from 5 mV/div to 5 V/div, are in a 1, 2, 5 sequence. The input coupling (50Ω, DC, GND, AC) is also determined in the attenuators. The attenuators accept the input signal from the front-panel INPUT jack.

4-7. IMPEDANCE CONVERTER.

4-8. The attenuator output is applied to differential impedance converter A6Q1A/Q1B. The impedance converter A6Q1A changes the single-ended, high-impedance input signal to a low-impedance, single-ended output. A6Q1B provides the dc offset and channel balance capability.

4-9. PREAMPLIFIER.

4-10. Differential amplifier A6Q2/Q3 provides the first stage of conversion from a single-ended signal to a differential signal. This amplification stage also performs channel A gain adjust. Channel B has a fixed gain and channel A is adjusted to equal channel B.

4-11. CHANNEL A CONTROL.

4-12. The main amplifier consists primarily of a control chip A6U1. A6U1 is an integrated circuit that will accept a differential input and provide two differential outputs. One output is the main signal path which after amplification will be displayed on the CRT. The second differential output is fed to the sync amplifier, A6Q9 through A6Q12.

4-13. The control chip also provides all functions necessary for the front-panel controls of the vertical system.

4-14. SYNC AMPLIFIER.

4-15. The channel A sync signal is combined with the channel B sync signal at the outputs of A6U1 and A6U2. The summed output from A6U1 and A6U2 is the differential input to sync amplifier A6Q9/Q12. The sync amplifier provides a gain of at least 10.

4-16. The differential output of the sync amplifier is separated into two signals. One signal is fed into a complementary emitter follower, A6Q13/Q14, that provides a low impedance source for the time base plug-in.

4-17. The other sync amplifier output is fed into emitter follower A6Q15/16 which is used to compensate for dc drift and is also applied to the front-panel connector VERT OUT. The output impedance of emitter follower A6Q15/Q16 is 50 ohms.

4-18. DELAY LINE.

4-19. The output from channel control A6U1 is applied to delay line drivers A6Q7/Q8. The delay line delays the vertical signal long enough to allow the sweep to trigger.

4-20. MAIN AMPLIFIER.

4-21. The main amplifier, A7, consists primarily of an integrated circuit, A7U1. The remainder of the circuit provides high frequency adjustment and gain adjustment. Gain is adjusted by two variable resistors, R6 and A7R8. In addition, the main amplifier provides the necessary current gain for output amplifier Q1/Q2 and Q3/Q4.

4-22. OUTPUT AMPLIFIER.

4-23. Integrated circuit, A7U1, provides two outputs. One side drives output amplifier Q1/Q2 and the other drives output amplifier Q3/Q4. Each output amplifier has a feedback signal to its input for compensation, which is adjustable with A8C1. The vertical deflection signal from the output amplifiers, Q1/Q2 and Q3/Q4, is applied to the CRT deflection plates.

4-24. CONTROL CIRCUIT.

4-25. Control circuit A3 selects the type of display to be presented on the CRT; channel A, channel B, channels A and B, ALT or CHOP mode.

4-26. The pulse shaper, A3U1, receives a signal from the oscilloscope mainframe that indicates the end of the gate pulse. The signal is shaped in one-half of A3U1 and fed into the J-K flip-flop. The J-K flip-flop changes state after the completion of each sweep, causing the trace on the CRT to alternate between channels A and B. The chop oscillator is disabled in the ALT mode.

4-27. In the CHOP mode, the chop oscillator is enabled and the pulse shaper is disabled; turning off the ALT signal from the oscilloscope mainframe. The chop oscillator switches the trace between channels A and B at a rate of 400 kHz. The chop oscillator also drives chop blanking circuit A3Q1/Q2. This circuit blanks the CRT during transition between channels.

4-28. The J-K flip-flop is connected to two current switches. A3Q3/Q4 is the on-off control for the main signal path. A3Q5 through A3Q8 is the on-off control for the sync signal path. The current switches control on-off switches in IC A6U1 and A6U2.

4-29. Channel control current switch A3Q3/Q4 always follows the J-K flip-flop, but can be over ridden by TRIG SOURCE pushbutton A or B.

4-30. POWER SUPPLY.

4-31. The Model 1805A power supply operates on 115 Vac line from the oscilloscope mainframe. The power supply rectifies and filters the line voltage into +20 Vdc. The +20 Vdc is added to +15 Vdc from the mainframe to provide the +35 Vdc operating power.

4-32. Transformer T1 is connected to the mainframe transformer, which provides proper operating voltage to the Model 1805A whether the oscilloscope is being operated from 115 Vac or 230 Vac.

4-33. DETAILED CIRCUIT.

4-34. The following paragraphs provide a detailed explanation of the individual circuits in the Model 1805A. Circuits that are identical for both channels are explained for channel A.

4-35. ATTENUATORS A10 AND A11. (See schematic 1.)

4-36. The Model 1805A employs a two-section, cam-actuated attenuator consisting of 17 in-line cams. The first three cams form coupling switch A10S1. The other 14 cams form the VOLTS/DIV switch, A10S2. The cams actuate pushrods to close spring switch contacts A10A1S1 through A10A1S17 on thick-film substrate A10A1. The spring switch contacts are normally open, except when closed by the cam-actuated push rods.

4-37. The first three cams form coupling switch A10S1 and actuate spring switch contacts A10A1S1 through A10A1S3. A table located on schematic 1 explains the switch closure sequence for each of the front-panel coupling switch positions.

4-38. The last 14 cams form VOLTS/DIV switch A10S2 and actuate spring switch contacts A10A1S4 through A10A1S17. A table located on schematic 1 explains the switch closure sequence for each front-panel VOLTS/DIV setting.

4-39. The VOLTS/DIV switch is a compensated RC type attenuator consisting of two sections. Each section is made up of a group of attenuation networks. The first section contains X1, X10, and X100 networks. The second section has X1, X2, X4, and X10 networks. Each switch position cascades a network from the first section with a network from the second section. Different network combinations are cascaded to provide attenuation from 5 mV/div to 5 volts/div vertical deflection.

4-40. Each attenuator network has input capacitance adjustments as well as compensation adjustments. The straight-through range, .005 volts/div, is not adjustable. The input capacitance for each range is matched to the input capacitance of the straight-through range to achieve a uniform input capacitance over the entire range of inputs. The other attenuator adjustments provide for high frequency compensation.

4-41. PREAMPLIFIER. (See schematic 2.)

4-42. Dual FET A6Q1 is an impedance converter that provides a high input impedance to the attenuator and a low output impedance to differential amplifier A6Q2/Q3.

4-43. Impedance converter A6Q1 has two inputs. One input is from attenuator A10 and is applied to the gate of A6Q1A. The other input is the sum of the voltages from the front-panel OFFSET control and the internal channel A balance control. The dual input provides a ±1 volt offset shift.

4-44. Differential amplifier A6Q2/Q3 converts the single-ended input signal from the impedance converter to a differential output. Resistors A6R23/R24 cross couple the input signal from A6Q2 to A6Q3. Capacitor A6C23 provides high frequency compensation. Channel A gain adjust A6R35 is also part of amplifier stage A6Q2/Q3. Channel B has a fixed gain and channel A gain is adjusted to equal channel B gain.

4-45. Channel A control A6U1 is a medium scale integrated circuit that controls all vertical functions necessary for oscilloscope operation.

4-46. The differential output from A6Q2/Q3 is fed into A6U1 where it is converted into two differential outputs. One output is the main signal which, after amplification, is displayed on the CRT. The second differential output is used in the sync amplifier.

4-47. Channel A and channel B signals are combined at the outputs of A6U1 and A6U2. The sync signals are also combined at the outputs of A6U1 and A6U2. The signal displayed on the CRT, channel A or channel B or channels A + B, is determined by which integrated circuit is turned on.

4-48. The summed outputs of A6U1/U2 is the input to the delay-line drivers A6Q7/Q8. A6Q7/Q8 is a differential amplifier that is temperature compensated. Temperature variations within Model 1805A cause a resistance change is thermistor A6RT1. The resulting voltage change causes the capacitance in varactors A6C66 and A6C67 to change. The change in capacitance on emitters of A6Q7/Q8 maintains constant frequency response throughout the 100-MHz range of the Model 1805A.

4-49. Delay-line drivers A6Q7/Q8 also incorporate the oscilloscope find beam function. When the find beam pushbutton is pressed, —12.6V is removed through A6R96 to the junction of A6R94/95. The resulting change in bias voltage reduces the amplifier gain sufficiently to bring the vertical display on screen.

4-50. DELAY LINE. (See schematic 4.)

4-51. The delay-line provides 160 nanoseconds of delay to the vertical signal to allow sufficient time for the sweep circuit to trigger.

4-52. MAIN AMPLIFIER. (See schematic 4.)

4-53. The main amplifier A7 contains an integrated circuit that provides the current gain for the entire system. The gain of A7U1 is adjusted by cal A7R8 and front panel CAL control R6. These adjustments are used to calibrate the Model 1805A to the different oscilloscope mainframes.

4-54. OUTPUT AMPLIFIER. (See schematic 4.)

4-55. Signals from the main amplifier drive two shunt output amplifiers that provide the voltage gain necessary to drive the CRT. One side drives shunt output amplifier Q1/Q2 and the other side drives shunt output amplifier Q3/Q4. Each amplifier feeds a portion of its output signal back to its input through a compensation network. Amplifier Q3/Q4 has a high frequency corner adjustment HF1. The vertical deflection signal from the output amplifier is applied to the CRT deflection plates in the oscilloscope mainframe.

4-56. SYNC AMPLIFIER. (See schematic 3.)

4-57. The two sync signals from channel A and B are combined at the output of the channel control, A6U1. The combined signal is applied to amplifier A6Q9 through A6Q12.

4-58. The sync amplifier consists of series feedback pair A6Q9/Q10 followed by a shunt feedback pair A6Q11/Q12. Feedback amplifier A6Q11/Q12 is the last gain stage for the internal trigger signal.

4-59. The amplified signal is separated into two signals; one is applied to complimentary emitter follower A6Q13/Q14, and the other is applied to the emitter follower A6Q15/Q16.

4-60. Complimentary emitter follower A6Q13/Q14 provides a low impedance signal to synchronize the time base. Emitter follower A6Q15/Q16 provides a gain of 10, when in the .005 volts/division range, to the front-panel VERT OUT connector.

Table 5-1. Recommended Test Equipment

Instrument Type	Recommended Model	Required Characteristics	Required For
Oscilloscope Mainframe Time Base	HP 180C HP 1820B	HP 180, 181, 182, or 183 system HP 1820A/B/C, 1821A, 1822A, 1824A or 1825A plug-in	Performance Checks, Adjustments, and Troubleshooting
Voltmeter Calibrator	HP 738BR	400-Hz rep rate, 30-mV to 4V amplitude, accuracy 0.2%	Deflection Factor Accuracy Check, Vernier Check, DC Offset Voltage. Volts/div Cal Adjust
Constant amplitude Signal Generator	Tektronix Type 191	50-kHz to 100-MHz rep rate, 120-mV to 5V amplitude, constant amplitude	Bandwidth Check, CMR Check, Vertical Output Amplitude, Vertical Output Bandwidth
Square Wave Generator	HP 211B	1-kHz rep rate, 30-mV amplitude	Attenuator Adjustment
Pulse Generator	Tektronix Type 106	Risetime $\leq$1.0 ns, amplitude $\geq$0.5V overshoot and ringing $<$2%, pulse width $>$1 usec, perturbation $<$1%	Risetime Check, Pulse Response Adjustment
50-ohm BNC Tee Connector	HP 1250-0787	BNC connector	CMR Check, Vertical Output, Bandwidth
10:1 Probe	HP 10004C	10:1 division ratio, 10 megohm shunted by approx 10 pF Input RC, 8 to 28 pF compensation range	Polarity Check, Vertical Output,Bandwidth
Plug-in Extender	HP 10407B	HP 180-system plug-in extender	Adjustments and Troubleshooting
VHF Oscillator	HP 3200B	100-MHz, 120-mW, 50-ohm output impedance	VSWR Check
Vector Voltmeter	HP 8405A	100-MHz, 300 μV to 1.0V ranges, dual channel	VSWR Check
Coaxial Dual Directional Coupler	HP 778D	100-MHz frequency range	VSWR Check
10-dB Attenuator	GR 874 G10	10-dB attenuation, Type-n connectors	Bandwidth Check VSWR Check
50-ohm Tee	HP 11536A	50-ohm Tee, Type-N input, Type-N output	VSWR Check
50-ohm Termination	HP 908A	Type-N connector, 2 required	Vertical Output Bandwidth, VSWR
RF Voltmeter	HP 3406A	10-kHz to 1.2 GHz, 1-mV to 3V amplitude	Vertical Output Bandwidth Check

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SECTION V

PERFORMANCE CHECKS AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for checking the instrument specifications as given in table 1-1 of this manual. A table (performance check record) is provided at the end of the performance check for recording the measurements obtained in the first running of the procedure. This record may be used to compare measurements taken at later dates with the original. The procedures for making all internal adjustments are covered in paragraphs 5-21 through 5-30. Figure 5-10, located on a foldout page at the end of this section, shows all the adjustment locations.

5-3. REQUIRED TEST EQUIPMENT.

5-4. Test equipment recommended for both the performance check and adjustment procedure is listed in table 5-1. Similar equipment may be substituted, provided it meets or exceeds the required characteristics listed in the table.

5-5. PERFORMANCE CHECK.

5-6. The performance check verifies whether or not the Model 1805A is operating within the specifications as listed in table 1-1. Use this check as part of an incoming quality control inspection, as a periodic operational check, or after repairs and/or adjustments have been made. Any one of the following checks can be made separately if desired.

5-7. The first time the performance check is made, enter the results on the performance check record at the end of the procedure. Remove the record from the manual and file it for future reference. Be sure to include the instrument serial number on the record for identification.

5-8. INITIAL CONTROL SETTINGS.

a. Install Model 1805A with time base plug-in into oscilloscope mainframe and turn on mainframe power. Allow 15 minutes warm up for stabilization.

b. Set Model 1805A front-panel controls as follows:

POSITION A and B	midrange
DISPLAY	A
TRIG SOURCE	A
Polarity A and B	+UP
VERNIER A and B	CAL
CAL	midrange
Coupling A and B	DC
VOLTS/DIV A and B	.005

c. Set oscilloscope and time base controls to obtain stable trace on CRT.

5-9. INITIAL CHECKS.

a. Set Model 1805A front-panel controls as shown in paragraph 5-8.

Table 5-1. Recommended Test Equipment (Cont'd)

Instrument Type	Recommended Model	Required Characteristics	Required For
50-ohm Tee	HP 11063A	50-ohm Tee GR type connections	Vertical Output Bandwidth Check
LC Meter	Tektronix Type 130	20 to 50 pF 3%	Attenuator Adjustment
Monitor Oscilloscope	HP 180-series	50-MHz system	Volts/div Cal Adjustment
Voltmeter	HP 414A	5-mV, 10 volts, ±1%	Sync Level Adjustment Vert Out Level Adjustment
50-ohm Coaxial Cable	HP 11086A	50-ohm coaxial cable BNC male connectors both ends 24 inches	VSWR
50-ohm Coaxial Cable	HP 10502A	50-ohm coaxial cable BNC male connectors both ends 9 inches	VSWR

b. Set DISPLAY to ALT. Two traces should appear on CRT screen.

c. Set TRIG SOURCE to B. Two traces should appear on CRT screen.

d. Rotate channel A POSITION over its range. Channel A trace should move full vertical graticule range.

e. Rotate channel B POSITION over its range. Channel B trace should move full vertical graticule range.

f. Set DISPLAY to A + B (both pushbuttons pressed in). Either channel POSITION control should move trace vertically.

g. If instrument fails to meet check, refer to Section VIII of this manual for troubleshooting information.

5-10. POLARITY CHECK.

a. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

VOLTS/DIV A and B 5

b. Center trace.

c. Apply calibrator signal to channel A INPUT through 10:1 probe as shown in figure 5-1.

d. Observe square wave in lower half of CRT.

e. Switch polarity to –UP. Observe square wave in upper half of CRT.

f. Repeat steps c through e for channel B.

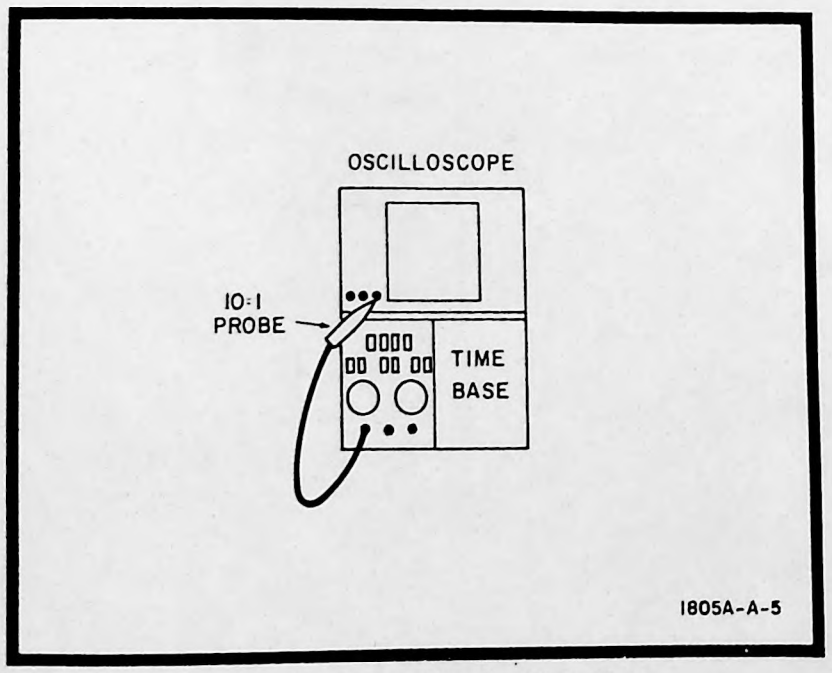


Figure 5-1. Polarity Check Test Setup

g. Disconnect calibrator signal.

h. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-11. DEFLECTION FACTOR ACCURACY CHECK.

a. Connect equipment as shown in figure 5-2.

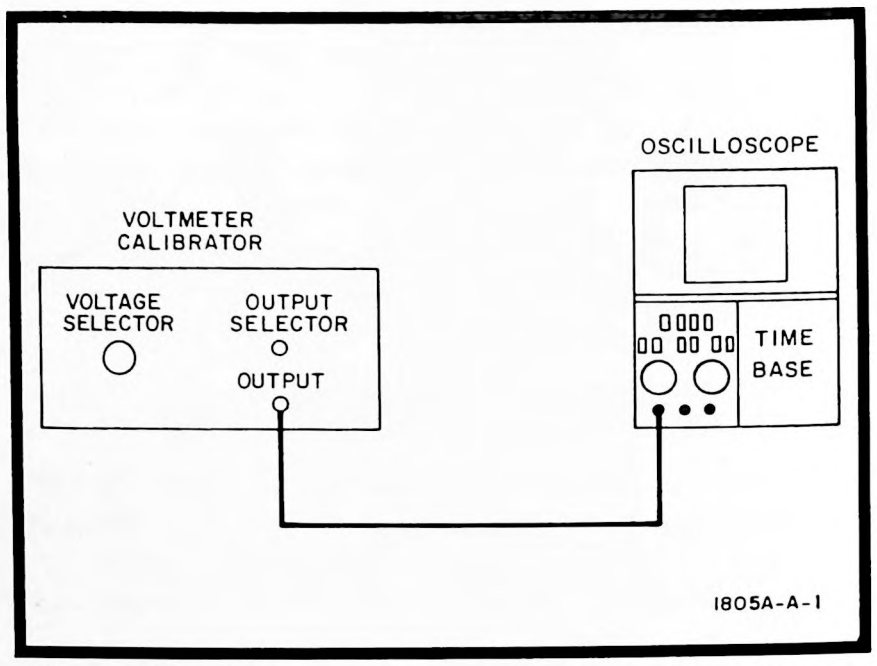


Figure 5-2. Deflection Factor Accuracy Test Setup

b. Set Model 1805A front-panel controls as shown in paragraph 5-8.

c. Set voltmeter calibrator for 400-Hz, 30-mV p-p output.

d. Set time base controls to display approximately four cycles.

e. Adjust CAL for 6-division display.

f. Make deflection factor accuracy checks listed in table 5-2.

Table 5-2. Deflection Factor Accuracy

Voltmeter Calibrator Volts (p-p)	VOLTS/DIV	Display Height (div)
.03	.005	6±0.12
.05	.01	5±0.10
.1	.02	5±0.10
.3	.05	6±0.12
.5	.1	5±0.10
1.0	.2	5±0.10
3.0	.5	6±0.12
5.0	1	5±0.10
10.0	2	5±0.10
30.0	5	6±0.12

g. Repeat steps a through f for channel B.

h. Disconnect test equipment.

i. If instrument fails to meet check in table 5-2, do VOLTS/DIV CAL ADJUST in paragraph 5-28. If instrument still fails check, refer to Section VIII for troubleshooting information.

5-12. VERNIER CHECK.

a. Connect equipment as shown in figure 5-3.

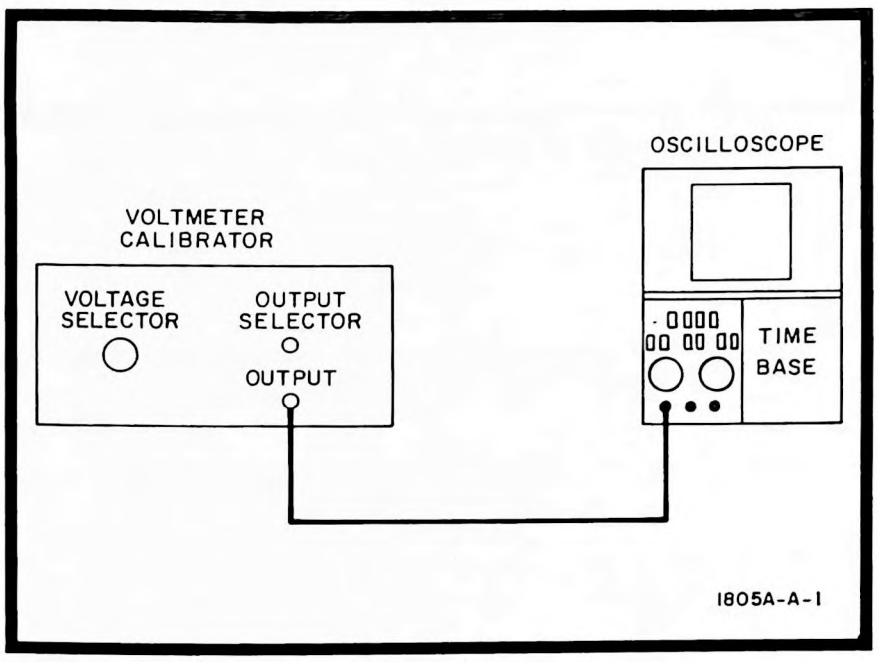


Figure 5-3. Vernier Test Setup

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for the following:

VOLTS/DIV A and B 5

c. Set voltmeter calibrator for 400-Hz, 30V p-p output.

d. Set time base controls to display approximately four cycles.

e. Rotate channel A VERNIER maximum ccw. Deflection factor shall be ⩽ 2.4 div.

f. Repeat steps a through d for channel B.

g. Rotate channel B VERNIER maximum ccw. Deflection factor shall be ⩽ 2.4 div.

h. Disconnect test equipment.

i. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-13. DC OFFSET VOLTAGE.

a. Connect voltmeter calibrator output to channel A INPUT.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Dc offset OFF-ON A and B . . . . . ON

c. Set voltmeter calibrator for +1 Vdc output. Should be able to adjust front-panel DC OFFSET to position trace on screen.

d. Set voltmeter calibrator for −1 Vdc output. Should be able to adjust front-panel DC OFFSET to position trace on screen.

e. Repeat steps a through d for channel B.

f. Disconnect test equipment.

g. If instrument fails to meet check, do DC BALANCE ADJUSTMENT in paragraph 5-24. If instrument still fails check, refer to Section VIII for troubleshooting information.

5-14. RISETIME.

a. Connect equipment as shown in figure 5-4.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

VOLTS/DIV A and B 01
Coupling A and B 50Ω

c. Adjust pulse generator for 50-kHz, 60-mV output. Risetime shall be ⩽ 3.5 ns.

d. Repeat steps a through c for channel B.

e. Disconnect test equipment.

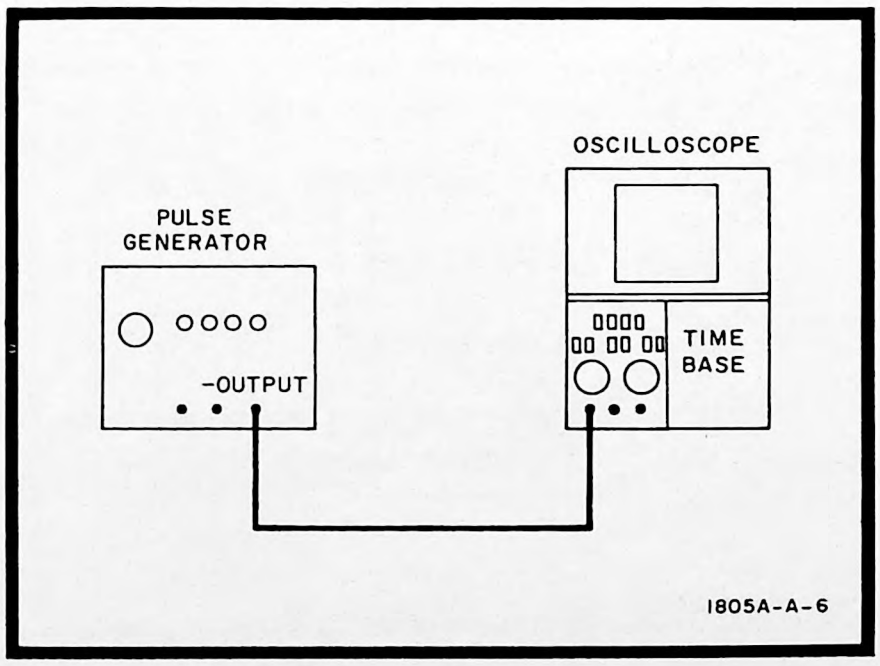


Figure 5-4. Risetime Test Setup

f. If instrument fails to meet check, do PULSE RESPONSE ADJUSTMENT in paragraph 5-30. If instrument still fails check, refer to Section VIII for troubleshooting information.

5-15. BANDWIDTH CHECK.

a. Connect equipment as shown in figure 5-5.

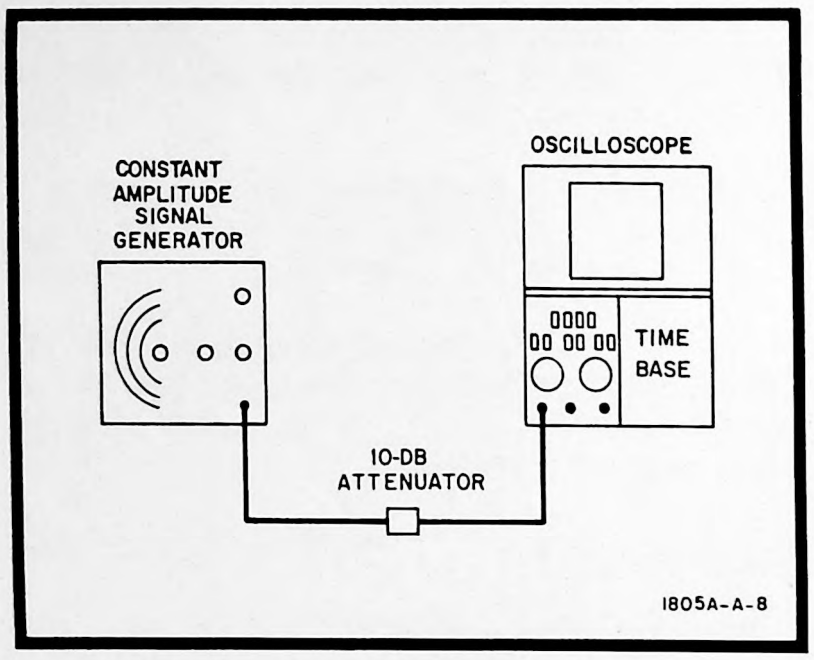


Figure 5-5. Bandwidth Test Setup

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B	50Ω

c. Set constant amplitude signal generator for 1-MHz output.

d. Adjust constant amplitude signal generator for 8-division display.

e. Increase constant amplitude signal generator frequency to 100 MHz. Deflection shall be ⩾ 5.6 divisions (3 dB down).

f. Reconnect constant amplitude signal generator and 10-dB attenuator to channel B INPUT.

g. Set DISPLAY and TRIG SOURCE to B.

h. Repeat steps c through e.

i. Disconnect test equipment.

j. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-16. COMMON MODE REJECTION.

a. Connect equipment as shown in figure 5-6.

Note

Coax. cables to channel A and B INPUTS must be of equal length and electrically identical.

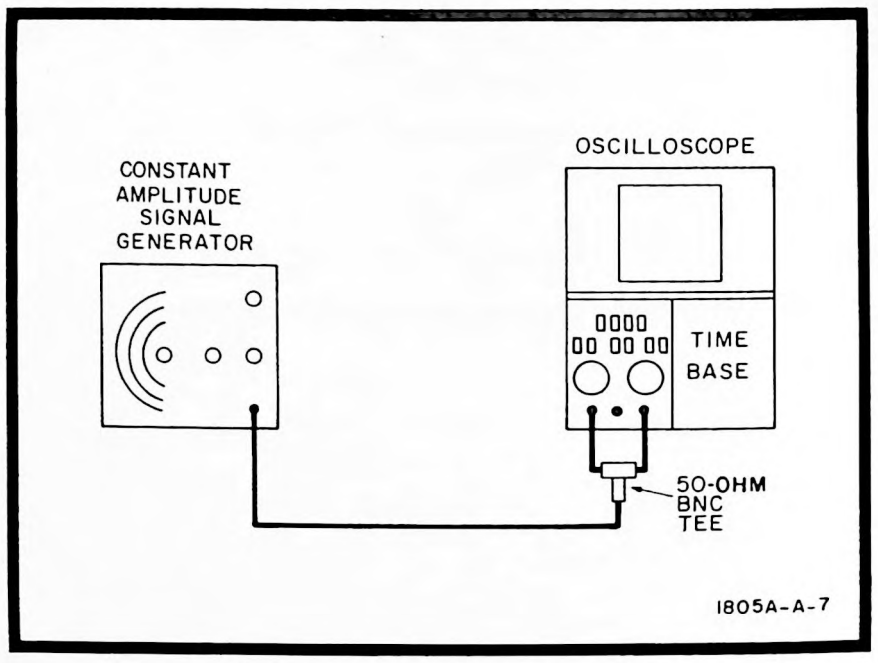


Figure 5-6. CMR Test Setup

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Polarity B	–UP
VOLTS/DIV A	.01
Coupling A and B	50Ω

c. Set constant amplitude signal generator output for 1-MHz, 8-division display.

d. Set channel A VOLTS/DIV to .005.

e. Set DISPLAY to A + B. Deflection shall be ⩽ 0.16 division.

f. Set DISPLAY to A.

g. Set constant amplitude signal generator output for 100-MHz, 6-division display.

h. Set DISPLAY to A + B. Deflection shall be ⩽0.6 division.

i. Disconnect test equipment.

j. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-17. VERTICAL OUTPUT AMPLITUDE.

a. Connect equipment as in figure 5-7.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

VOLTS/DIV B	.05
Coupling A and B	50Ω

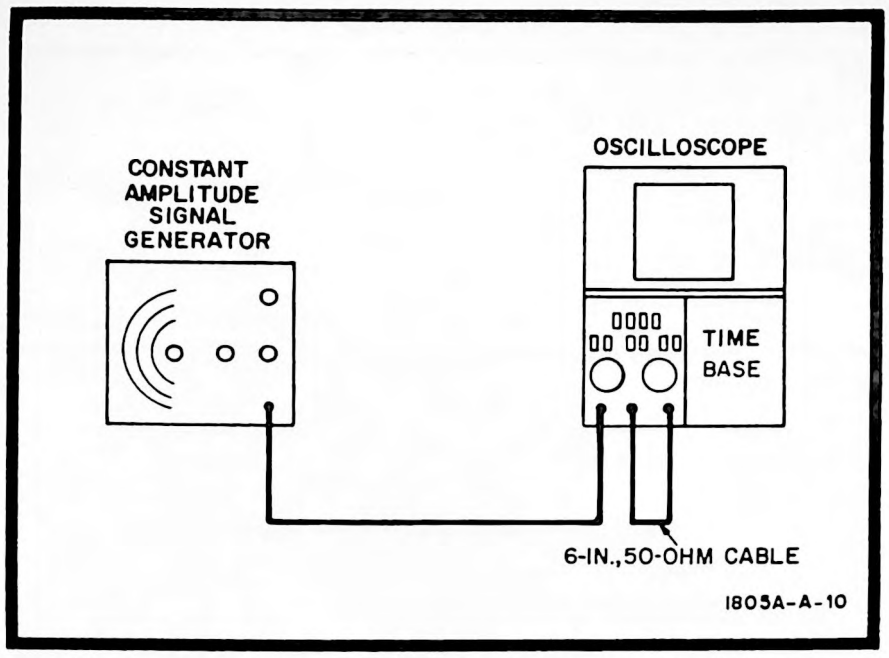


Figure 5-7. Vertical Output Amplitude Test Setup

c. Set constant amplitude signal generator output for 50-kHz, 5-division display.

d. Set DISPLAY to B. Deflection shall be ⩾ 5 divisions.

e. Disconnect test equipment.

f. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-18. VERTICAL OUTPUT BANDWIDTH.

a. Connect equipment as in figure 5-8.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B 50Ω

c. Set constant amplitude signal generator for 50-kHz output (approximately 6 divisions).

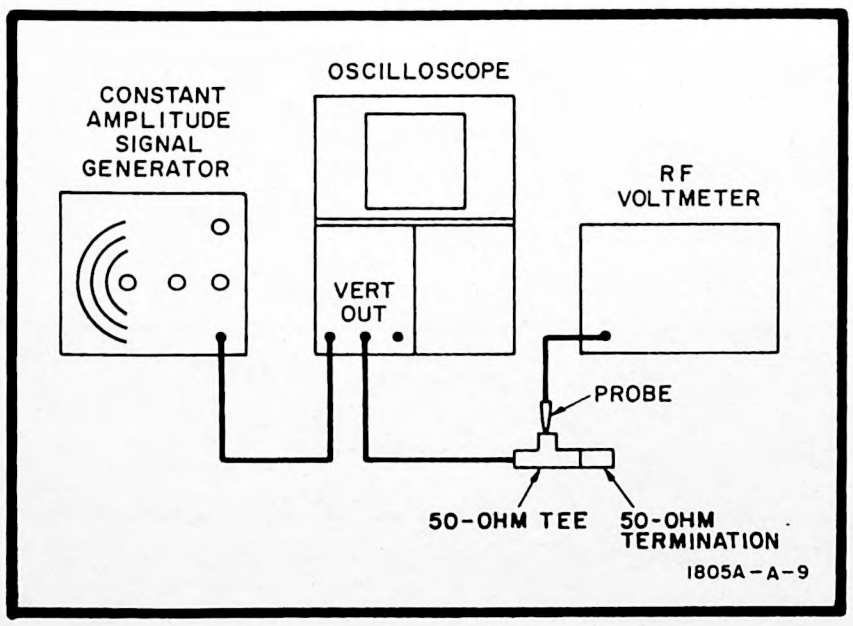


Figure 5-8. Vertical Output Bandwidth Test Setup

d. Adjust constant amplitude signal generator output for 300-mV indication on RF voltmeter.

e. Increase constant amplitude signal generator to 50 MHz. RF voltmeter should indicate > 212 mV p-p.

f. Disconnect test equipment.

g. If instrument fails to meet check, do VERT OUT LEVEL ADJUST in paragraph 5-27. If instrument still fails check, refer to Section VIII for troubleshooting information.

5-19. TRIGGERING.

a. Connect constant amplitude signal generator to channel A INPUT.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

VOLTS/DIV A 5

c. Observe displays as specified in table 5-3.

d. Disconnect test equipment.

e. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

5-20. VSWR CHECK.

a. Connect equipment as shown in figure 5-9.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B 50Ω

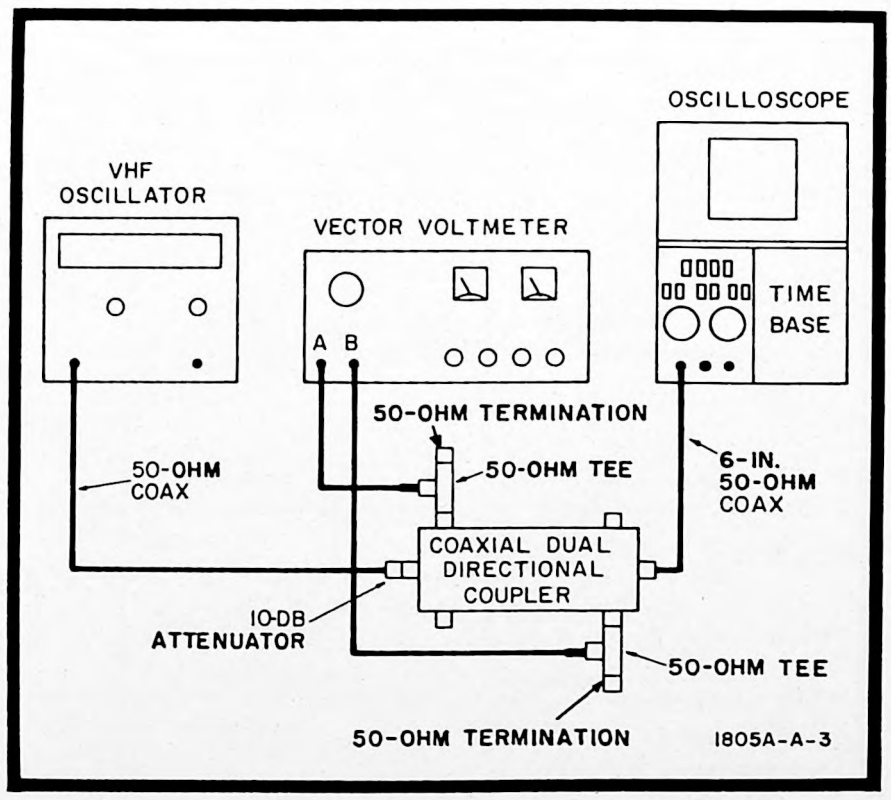


Figure 5-9. VSWR Test Setup

c. Set VHF oscillator for 100 MHz.

d. Set vector voltmeter to measure its channel A input.

e. Set channel A of vector voltmeter to −30-dB range.

f. Set VHF oscillator output to obtain 0-dB reading on vector voltmeter.

g. Set vector voltmeter to measure its channel B input.

h. Subtract channel B reading from channel A reading. Test result is given in table 5-4.

i. Switch Model 1805A channel A VOLTS/DIV through remaining ranges and check test results as given in table 5-4.

Table 5-4. VSWR

A − B (dB)	Reflection Coefficient	VSWR
>−23 dB	< 0.10	< 1.2:1

j. Repeat steps c through i for channel B.

k. Disconnect test equipment.

l. If instrument fails to meet check, refer to Section VIII for troubleshooting information.

Table 5-3. Triggering

Time Base Plug-in	Constant Amplitude Signal Generator	Vertical Deflection Required to Trigger
1820C, 1824A 1825A, 1840A	50 MHz	> 0.5 division
1841A	100 MHz	> 1 division
1820B, 1822A	50 MHz	> 0.5 division
	100 MHz	> 2 divisions
1820A, 1821A	50 MHz	> 1 division

PERFORMANCE CHECK RECORD

Model 1805A

Instrument Serial Number _____ **Date** _____

Check	Specification	Measured
INITIAL CHECKS		
ALT	two traces	_____
TRIG SOURCE B	two traces	_____
A POSITION	full range	_____
B POSITION	full range	_____
A + B	full range either position control	_____
POLARITY		
+UP	square wave lower half of CRT	_____
–UP	square wave upper half of CRT	_____
DEFLECTION FACTOR ACCURACY		A B
VOLTS/DIV		
.005	6±0.12 div	_____ _____
.01	5±0.10 div	_____ _____
.02	5±0.10 div	_____ _____
.05	6±0.12 div	_____ _____
.1	5±0.10 div	_____ _____
.2	5±0.10 div	_____ _____
.5	6±0.12 div	_____ _____
1	5±0.10 div	_____ _____
2	5±0.10 div	_____ _____
5	6±0.12 div	_____ _____
VOLTS/DIV VERNIER		A B
VOLTS/DIV Vernier ccw	⩽2.4 div	_____ _____
DC OFFSET VOLTAGE	adjust DC OFFSET to position trace on screen	A B _____ _____
RISETIME		A B
6-division display	⩽3.5 ns	_____ _____
BANDWIDTH		A B
100 MHz	⩾5.6 div	_____ _____
COMMON MODE REJECTION		A B
1 MHz	⩽0.16 div	_____ _____
100 MHz	⩽0.6 div	_____ _____
VERTICAL OUTPUT AMPLITUDE	⩾5 div	A B _____ _____

PERFORMANCE CHECK RECORD

Model 1805A

Instrument Serial Number _____ **Date** _____

Check	Specification	Measured
VERTICAL BANDWIDTH	>212 mV p-p	A _____ B _____
TRIGGERING		
Time Base Plug-in		
1820C	>0.5 division	
1824A	>0.5 division	
1825A	>0.5 division	
1840A	>0.5 division	
1841A	>1.0 division	
1820B	>0.5 division	
1822A	>0.5 division	
1820B	>2.0 divisions	
1822A	>2.0 divisions	
1820A	>1.0 division	
1821A	>1.0 division	
VSWR		A B
VOLTS/DIV		
.005	⩾ −23 dB	_____ _____
.01	⩾ −23 dB	_____ _____
.02	⩾ −23 dB	_____ _____
.05	⩾ −23 dB	_____ _____
.1	⩾ −23 dB	_____ _____
.2	⩾ −23 dB	_____ _____
.5	⩾ −23 dB	_____ _____
1	⩾ −23 dB	_____ _____
2	⩾ −23 dB	_____ _____
5	⩾ −23 dB	_____ _____

5-21. ADJUSTMENTS.

5-22. The following paragraphs describe procedures to calibrate the instrument so that it will perform as specified in table 1-1. The entire adjustment procedure can be done in sequence, or any separate adjustment can be done, providing paragraphs 5-24, 5-25, 5-26 and 5-27 are done in sequence. The locations of adjustment controls are shown in a photograph included at the end of the section on a foldout page.

5-23. Use a nonmetallic screwdriver and recently calibrated test equipment with characteristics as specified in table 5-1. After adjustments are complete, check instrument performance by doing the performance check procedure at the beginning of this section.

5-24. DC BALANCE ADJUSTMENT.

a. With no input to Model 1805A, set front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B . . . . . GND
Dc offset OFF-ON A and B . . . . . ON

b. Set time base for auto trigger.

c. Press oscilloscope find beam.

d. Adjust BAL, A7R13, until trace is symmetrical about the CRT center line, while rotating DC OFFSET through full range.

e. Set dc offset OFF-ON A and B to OFF.

f. Adjust channel A BAL, A2R5, for zero trace shift while switching channel A polarity from +UP to –UP.

g. Set DISPLAY switch to B.

h. Set TRIG SOURCE switch to B.

i. Adjust channel B Bal, A2R9, for zero trace shift while switching channel B polarity from +UP to –UP.

5-25. SYNC BALANCE ADJUSTMENT.

a. With no input to Model 1805A, set front-panel controls as shown in paragraph 5-8, except for following:

TRIG SOURCE . . . . . COMP
Coupling A and B . . . . . GND

b. Connect monitor oscilloscope to VERT OUT connector.

c. Adjust SYNC BAL A, A6R56, for zero trace shift while switching channel A polarity from +UP to –UP.

d. Set DISPLAY switch to B.

e. Adjust SYNC BAL B, A6R59, for zero trace shift while switching from +UP to –UP.

f. Disconnect monitor oscilloscope.

5-26. SYNC LEVEL ADJUSTMENT.

a. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B . . . . . GND

b. Connect voltmeter to emitter of A6Q13 sync output.

c. Adjust SYNC LEVEL ADJ, A6R114, for –0.7-volt indication on voltmeter.

5-27. VERT OUT LEVEL ADJUST.

a. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B . . . . . GND

b. Connect voltmeter to front-panel connector VERT OUT.

c. Adjust VERT OUT ADJUST, A6R121, for 0 ±5 mV.

5-28. VOLTS/DIV CAL ADJUST.

a. Set 1805A front-panel controls as shown in paragraph 5-8, except for following:

DISPLAY . . . . . B
TRIG SOURCE . . . . . B

b. Connect voltmeter calibrator output to channel B INPUT.

c. Set voltmeter calibrator for 400-Hz, 30-mV p-p output.

d. Set time base for stable display.

e. Adjust front-panel VOLTS/DIV CAL R6 adjustment to midrange.

f. Connect monitor oscilloscope to collector of Q1 on output board A8.

g. Adjust CAL, A7R8 for 9-volt display on monitor oscilloscope.

h. Disconnect monitor oscilloscope.

i. Adjust front-panel VOLTS/DIV CAL R6 for 6-division display.

j. Set DISPLAY and TRIG SOURCE to A.

k. Connect voltmeter calibrator to channel A INPUT.

l. Set voltmeter calibrator for 400-Hz, 30-mV p-p output.

m. Set time base for stable display.

n. Adjust channel A gain adj, A6R35, for 6-division display.

o. Disconnect test equipment.

5-29. ATTENUATOR ADJUSTMENT.

a. Remove Model 1805A from mainframe.

b. Connect plug-in extender to Model 1805A.

c. Reinstall Model 1805A into mainframe.

d. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

DISPLAY ..... ALT
Coupling A and B ..... AC

e. Connect 10-kHz, 6-division square wave from square wave generator output to channel A INPUT.

f. Set VOLTS/DIV switch as in table 5-5 and make appropriate adjustments for best square wave.

Table 5-5. Compensation Adjustments

Range	Compensation Adj
.01 V/div	.01V COMP
.02 V/div	.02V COMP
.05 V/div	.05V COMP

g. Connect square wave generator to channel B INPUT.

h. Set TRIG SOURCE to B.

i. Repeat step f for channel B.

j. Disconnect test equipment.

k. Connect LC meter to channel A INPUT and measure input capacitance of .005 VOLTS/DIV range.

l. Set VOLTS/DIV switch as in table 5-6 and make appropriate adjustments to obtain same input capacitance as measured in step k.

Table 5-6. Attenuator Input Adjustments

Range	Input Adj
.01 V/div	.01V INPUT
.02 V/div	.02V INPUT
.05 V/div	.05V INPUT

m. Repeat steps k and l for channel B.

n. Disconnect test equipment.

o. Connect 10-kHz, 6-division square wave from square wave generator output to channel A INPUT.

p. Set VOLTS/DIV switch as in table 5-7 and appropriate adjustments for best square wave.

Table 5-7. Compensation Adjustment

Range	Compensation Adj
.1 V/div	.1 V COMP
1 V/div	1 V COMP

q. Repeat steps o and p for channel B.

r. Disconnect test equipment.

s. Connect LC meter to channel A INPUT.

t. Set VOLTS/DIV switch as in table 5-8 and make appropriate adjustments to obtain same capacitance as in .005 VOLTS/DIV range.

Table 5-8. Attenuator Input Adjustment

Range	Input Adj
.1 V/div	.1V INPUT
1 V/div	1V INPUT

u. Repeat steps s and t for channel B.

5-30. PULSE RESPONSE ADJUSTMENT.

a. Connect pulse generator output to channel A INPUT.

b. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:

Coupling A and B 50Ω

c. Set time base for 0.1 usec sweep.

d. Adjust pulse generator for 6-division pulse.

e. Make adjustments as listed in table 5-9 for best pulse response of channel A.

Note

Change sweep time as necessary to display the best pulse.

f. Measure pulse risetime. Risetime shall be less than 3.5 ns.

g. Set DISPLAY switch to B.

h. Set TRIG SOURCE switch to B.

i. Make adjustments as listed in table 5-10 for best pulse response of channel B.

Note

It may be necessary to readjust channel A.

j. Measure risetime. Risetime shall be less than 3.5 ns.

Table 5-9. Channel A Pulse Response Adjustments

High Frequency Corner Adjustment	Designation	Time/division
A7HF3	A7R5	5 uSec
A7HF2	A7R4	.2 uSec
A7HF4	A7C5	.05 uSec
A7HF1	A7R6	.05 uSec
A8HF1	A8C1	.05 uSec
A6HF2	A6R49	.05 uSec
A6HF1	A6C35	.05 uSec
A6HF5	A6C42	.05 uSec

Table 5-10. Channel B Pulse Response Adjustments

High Frequency Corner Adjustment	Designation	Time/division
A6HF4	A6R50	.05 uSec
A6HF3	A6C36	.05 uSec

t DISPLAY switch to B.

t TRIG SOURCE switch to B.

ake adjustments as listed in table 5-10 for response of channel B.

Note

may be necessary to readjust channel A.

easure risetime. Risetime shall be less than

ustments

Time/division
5 uSec
.2 uSec
.05 uSec
.05 uSec
.05 uSec
.05 uSec
.05 uSec
.05 uSec

justments

Time/division
.05 uSec
.05 uSec

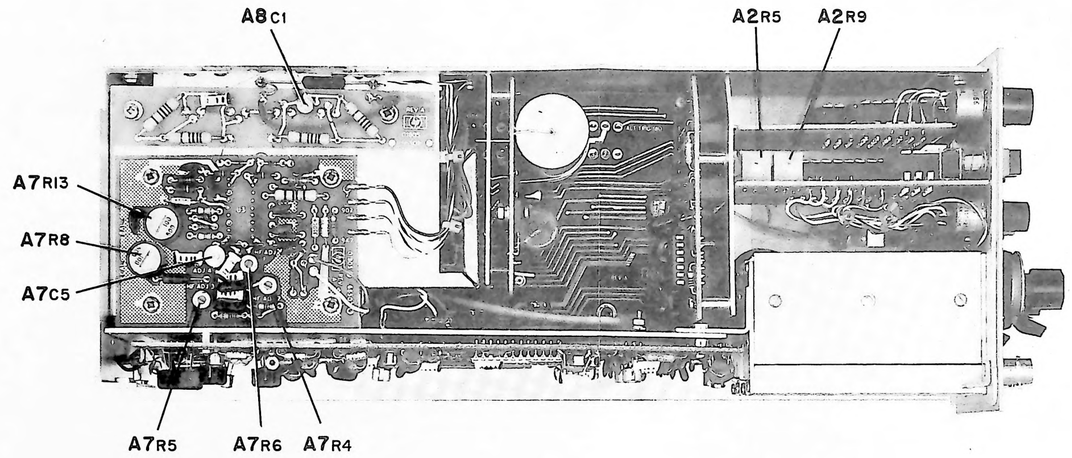


Figure 5-10.
Adjustment Locations
5-9/5-10

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. The abbreviations used in the parts list are described in table 6-1. Table 6-2 lists the parts in alphanumeric order by reference designator and includes the manufacturer and manufacturer's part number. Table 6-3 contains the list of manufacturers' codes.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts from Hewlett-Packard, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office and supply the following information:

a. Instrument model and serial number.

b. HP part number of items(s).

c. Quanity of part(s) desired.

d. Reference designator of part(s).

6-5. To order a part not listed in the table, provide the following information:

a. Instrument model and serial number.

b. Description of the part, including function and location in the instrument.

c. Quanity desired.

Table 6-1. Abbreviations for Replaceable Parts List

A	= ampere(s)
ASSY	= assembly
BD	= board(s)
BH	= binder head
BP	= bandpass
C	= centi (10^{-2})
CAR	= carbon
CCW	= counterclockwise
CER	= ceramic
CMO	= cabinet mount only
COAX	= coaxial
COEF	= coefficient
COMP	= composition
CONN	= connector(s)
CRT	= cathode-ray tube
CW	= clockwise
D	= deci (10^{-1})
DEPC	= deposited carbon
DP	= double pole
DT	= double throw
ELECT	= electrolytic
ENCAP	= encapsulated
EXT	= external
F	= farad(s)
FET	= field-effect transistor(s)
FH	= flat head
FIL H	= fillister head
FXD	= fixed
G	= giga (10^{9})
GE	= germanium
GL	= glass
GRD	= ground(ed)
H	= henry(ies)
HG	= mercury
HP	= Hewlett-Packard
HZ	= hertz
IF	= intermediate freq.
IMPG	= impregnated
INCD	= incandescent
INCL	= include(s)
INS	= insulation(ed)
INT	= internal
K	= kilo (10^{3})
KG	= kilogram
LB	= pound(s)
LH	= left hand
LIN	= linear taper
LOG	= logarithmic taper
LPF	= low-pass filter(s)
LVR	= lever
M	= milli (10^{-3})
MEG	= mega (10^{6})
MET FILM	= metal film
MET OX	= metal oxide
MFR	= manufacturer
MINAT	= miniature
MOM	= momentary
MTG	= mounting
MY	= mylar
N	= nano (10^{-9})
N/C	= normally closed
NE	= neon
N/O	= normally open
NPO	= negative positive zero (zero temperature coefficient)
NPN	= negative-positive-negative
NSR	= not separately replaceable
OBD	= order by description
OH	= oval head
OX	= oxide
P	= peak
PC	= printed (etched) circuit(s)
PF	= picofarads
PHL	= Phillips
PIV	= peak inverse voltage(s)
PNP	= positive-negative-positive
P/O	= part of
PORC	= porcelain
POS	= position(s)
POT	= potentiometer(s)
P-P	= peak-to-peak
PRGM	= program
PS	= polystyrene
PWV	= peak working voltage
RECT	= rectifier(s)
RF	= radio frequency
RFI	= radio frequency interference
RH	= round head or right hand
RMO	= rack mount only
RMS	= root mean square
RWV	= reverse working voltage
S-B	= slow-blow
SCR	= silicon controlled rectifier
SE	= selenium
SEC	= second(s)
SECT	= section(s)
SI	= silicon
SIL	= silver
SL	= slide
SP	= single pole
SPL	= special
ST	= single throw
STD	= standard
TA	= tantalum
TD	= time delay
TFL	= teflon
TGL	= toggle
THYR	= thyristor
TI	= titanium
TNLDIO	= tunnel diode(s)
TOL	= tolerance
TRIM	= trimmer
U	= micro (10^{-6})
V	= volts
VAR	= variable
VDCW	= dc working volt(s)
W	= watt(s)
W/	= with
WIV	= working inverse voltage
W/O	= without
WW	= wirewound

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS		
A1	01805–66501	1	BOARD ASSY:TOP SWITCH	28480	01805–66501
A2	01805–66502	1	BOARD ASSY:BOTTOM SWITCH	28480	01805–66502
A3	01805–66503	1	BOARD ASSY: CHANNEL SYNC	28480	01805–66503
A4	01805–66504	1	BOARD ASSY:MOTHER	28480	01805–66504
A5	01805–66505	1	BOARD ASSY:+3 5 VOLT SUPPLY	28480	01805–66505
A6	01805–66509	1	BOARD ASSY:PREAMP/SYNC	28480	01805–66509
A7	01805–66510	1	BOARD ASSY:MAIN AMPLIFIER	28480	01805–66510
A8	01805–66508	1	BOARD ASSY:OUTPUT	28480	01805–66508
A9	01805–61605	1	CABLE ASSY:DELAY LINE	28480	01805–61605
A10	01805–63401	1	ATTENUATOR ASSY:CHANNEL A	28480	01805–63401
A11	01805–63402	1	ATTENUATOR ASSY:CHANNEL B	28480	01805–63402
DS1	2140–0352	1	LAMP:INCANDESCENT 5.0V 0.06A	71744	683
E1	0360–1481	2	TERMINAL:SOLDER STUD BRASS	28480	0360–1481
E2	5000–0543	4	HOLDER:TRANSISTOR	28480	5000–0543
E3	5020–0513	4	CONTACT:ELECTRICAL	28480	5020–0513
E4	00183–67701	1	BASE:PILOT LIGHT	28480	00183–67701
E5	5080–9670		TSTR:MATCHED PAIR	28480	5080–9670
J1			PART OF W1		
J2	1250–0897	1	CONNECTOR:PF BULKHEAD JACK RECEPTACLE	98291	52–149–0000
J3	5060–0467	1	CONNECTOR:PROBE POWER	28480	5060–0467
MP1	0340–0039	6	INSULATOR:BUSHING	28480	0340–0039
MP2	0340–0152	4	INSULATOR:TRANSISTOR	28480	0340–0152
MP3	0370–0432	2	KNOB:BLACK LEVER	28480	0370–0432
MP4	0370–0451	8	BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370–0451
MP5	0370–0938	2	BEZEL, PUSHBUTTON KNOB:GRAY	28480	0370–0938
MP6	1490–0968	1	BUSHING:POTENTIOMETER 1/4–32 EXT THRD	00000	OBD
MP7	5040–5905	1	SPACER:VOLTS/DIV CHANNEL B	28480	5040–5905
MP8	5040–5906	1	SPACER:VOLTS/DIV CHANNEL A	28480	5040–5906
MP9	00180–67402	2	KNOB:ASSY BLK ARROW		
MP10	00183–67406	6	PUSHBUTTON ASSY	28480	00183–67406
MP11	01803–67407	2	KNOB ASSY:CAL	28480	01803–67407
MP12	01805–00201	1	PANEL:FRONT	28480	01805–00201
MP13	01805–00202	1	PANEL:SUB	28480	01805–00202
MP14	01805–00203	1	PANEL:REAR	28480	01805–00203
MP15	01805–00602	1	SHIELD:SWITCH BOARD	28480	01805–00602
MP16	01805–01202	1	BRACKET:ATTENUATOR	28480	01805–01202
MP17	01805–01203	1	BRACKET:POWER SUPPLY	28480	01805–01203
MP18	01805–04701	1	SUPPORT:PLUG–IN	28480	01805–04701
MP19	01805–60101	1	CHASSIS ASSY	28480	01805–60101
MP20	01805–67401	2	KNOB ASSY:ATTENUATOR	28480	01805–67401
MP21	01805–67402	2	KNOB ASSY:BLANK	28480	01805–67402
MP22	01830–67402	2	PUSHBUTTON	28480	01830–67402
MP23	01841–67404	2	PUSHBUTTON ASSY	28480	01841–67404
MP24	01805–04102	1	COVER:PRE AMP	28480	01805–04102
Q1	1854–0247	4	TSTR:SI NPN	28480	1854–0247
Q2	1854–0247		TSTR:SI NPN	28480	1854–0247
Q3	1854–0247		TSTR:SI NPN	28480	1854–0247
Q4	1854–0247		TSTR:SI NPN	28480	1854–0247
R1	0811–3151	1	R:FXD WW 140 OHM 1% 3W	28480	0811–3151
R2	0811–3150	2	R:FXD WW 560 OHM 1% 7W	28480	0811–3150
R3	0811–3150		R:FXD WW 560 OHM 1% 7W	28480	0811–3150
R4	2100–2066	2	R:VAR COMP 2K OHM 20% LIN 1/2W	28480	2100–2066
R5	2100–2066		R:VAR COMP 2K OHM 20% LIN 1/2W	28480	2100–2066
R6	2100–2062	1	R:VAR COMP 500 OHM 10% LIN 1/2W	28480	2100–2062
R7	2100–2568	4	R:VAR COMP 5K OHM 10% 10 CLOG 1/4W	28480	2100–2568
R8	2100–2568		R:VAR COMP 5K OHM 10% 10 CLOG 1/4W	28480	2100–2568
R9	2100–2568	2	R:VAR COMP 5K OHM 10% 10 CLOG 1/4W	28480	2100–2568
R10	2100–2568		R:VAR COMP 5K OHM 10% 10 CLOG 1/4W	28480	2100–2568
W1	01805–61602	1	CABLE ASSY:VERTICAL OUTPUT	28480	01805–61602

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01805-66501	1	BOARD ASSY:TOP SWITCH	28480	01805-66501
A1CR1	1901-0040	8	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1R1	0684-1031	4	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R2	0698-3439	2	R:FXD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A1R3	0698-3439		R:FXD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A1S1	3101-1695	1	PUSHBUTTON SWITCH ASSY	28480	3101-1695
A1S2			PART OF A1S1		
A1S3			PART OF A1S1		
A1S4			PART OF A1S1		
A1TB1	01805-26501	1	BOARD:BLANK PC	28480	01805-26501
A2	01805-66502	1	BOARD ASSY:BOTTOM SWITCH	28480	01805-66502
A2R1	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R2	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A2R3	0757-0464	2	R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464
A2R4	0757-0279	2	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A2R5	2100-3203	2	R:VAR 5K OHM	28480	2100-3203
A2R6	0757-0430	2	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A2R7	0757-0464		R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464
A2R8	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A2R9	2100-3203		R:VAR 5K OHM	28480	2100-3203
A2R10	0757-0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A2R11	0757-0415	4	R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A2R12	0757-0442	2	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R13	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A2R14	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R15	0757-0814	2	R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A2S1	3101-1696	1	PUSHBUTTON SWITCH ASSY	28480	3101-1696
A2S2			PART OF A2S1		
A2S3			PART OF A2S1		
A2S4			PART OF A2S1		
A2S5			PART OF A2S1		
A2S6			PART OF A2S1		
A2TB1	01805-26502	1	BOARD:BLANK PC	28480	01805-26502
A2VR1	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A3	01805-66503	1	BOARD ASSY:CHANNEL/SYNC	28480	01805-66503
A3C1	0160-3451	44	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A3C2	0140-0149	1	C:FXD MICA 470 PF 5%	72136	DM15F471J3S
A3C3	0180-0291	7	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3C4	0160-2215	2	C:FXD MICA 750 PF 5%	28480	0160-2215
A3C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3C6	0160-2215		C:FXD MICA 750 PF 5%	28480	0160-2215
A3C7	0150-0059	1	C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJO-339C
A3C8	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A3C9	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3C10	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A3C11	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3C12	0140-0198	2	C:FXD MICA 200 PF 5%	72136	ROM15F201J3C
A3CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3Q1	1854-0071	11	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3R1	0757-0283	1	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A3R2	0757-0198	1	R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
A3R3	0757-0444	4	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A3R4	0757-0441	1	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A3R5	0698-3150	1	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R6	0757-0273	2	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A3R7	0757-0407	12	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A3R8	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A3R9	0757-0437	1	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A3R10	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A3R11	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A3R12	0698-0084	1	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A3R13	0757-0427	2	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A3R14	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A3U1	1820-0142	1	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	04713	MC1004P
A3U2	1820-0102	1	INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P
A3VR1	1902-3096	1	DIODE BREAKDOWN:5.23V 5% 400 MW	28480	1902-3096

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3XA1	1251-2034	2	CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A3XA2	1251-2034		CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A3XU1	1200-0441	2	SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A3XU2	1200-0441		SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A4	01805-66504	1	BOARD ASSY:MOTHER	28480	01805-66504
A4C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C3	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C7	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C8	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C10	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C11	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C12	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C13	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C14	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C15	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C16	0180-0094		C:FXD ELECT 100UF +75 -10% 25VDCW	56289	30D107G025DD2-DSM
A4C17	0180-0094		C:FXD ELECT 100UF +75 -10% 25VDCW	56289	30D107G025DD2-DSM
A4P1	01801-27601	1	P:MALE 24 PIN	28480	01801-27601
A4XA3	1251-2026	1	CONNECTOR:PC 36 CONTACTS	71785	252-18-30-300
A4XA5	1251-0472	1	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A4XA6	1251-1626		CONNECTOR:PC (2 X12) 24 CONTACT	71785	252-12-30-300
A5	01805-66505	1	BOARD ASSY: +35 VOLT SUPPLY	28480	01805-66505
A5C1	0160-3665	1	C:FXD CER 0.01 UF +80 -20% 500VDCW	56289	C071A501K103ZS25-CDH
A5C2	0180-2351	1	C:FXD ELECT 2000 UF +75 -10% 50VDCW	56289	39D243
A5C3	0160-3451		C:FXD CER 0.01 UF +80 -20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C5	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A5CR1	1901-0045	4	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A5CR2	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A5CR3	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A5CR4	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A5Q1	1854-0013	1	TSTR:SI NPN	80131	2N2218A
A5Q2	1854-0300	1	TSTR:SI NPN	28480	1854-0300
A5Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5R1	0757-0124	1	R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A5R2	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A5R3	0811-1670	1	R:FXD WW 2.2 OHM 5% 2W	28480	0811-1670
A5R4	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A5R5	0684-6831	1	R:FXD COMP 68K OHM 10% 1/4W	01121	CB 6831
A5TB1	01805-26505	1	BOARD:BLANK PC	28480	01805-26505
A5Z	5020-0495		PIN:SQUARE(TEST POINTS)	28480	5020-0495
A6	01805-66509	1	BOARD ASSY:PREAMP/SYNC	28480	01805-66509
A6C1	0160-3508	2	C:FXD CER 1.0 UF +80-20% 50VDCW	72982	8131-050 651 105M
A6C2	0160-3508		C:FXD CER 1.0 UF +80-20% 50VDCW	72982	8131-050 651 105M
A6C3	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C4	0160-3558	8	C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C5	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C6	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C7	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C8	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C10	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C11	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C12	0180-0230	15	C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6C13	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6C14	0180-0197	1	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C15	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C16	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C17	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C18	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C19	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C20	0160-3558		C:FXD CER 0.1 UF 20% 50VDCW	72982	8121-050-651-104M
A6C21	0160-3567	4	C:FXD CER 10.0 PF 5% 100VDCW	72982	8101-100-COG-100J
A6C22	0160-3567		C:FXD CER 10.0 PF 5% 100VDCW	72982	8101-100-COG-100J
A6C23	0160-3652	2	C:FXD CER 4.7 PF 200VDCW	72982	8101-A200-COG-479K
A6C24	0160-3652		C:FXD CER 4.7 PF 200VDCW	72982	8101-A200-COG-479K
A6C25	0160-3447	4	C:FXD CER 470 PF 10% 1000VDCW	56289	C016B102F471KS25-CDH
A6C26	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6C27	0160–3447		C:FXD CER 470 PF 10% 100VDCW	56289	C016B102F471KS25–CDH
A6C28	0160–3447		C:FXD CER 470 PF 10% 100VDCW	56289	C016B102F471KS25–CDH
A6C29	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C30	0160–3447		C:FXD CER 470 PF 10% 1000VDCW	56289	C016B102F471KS25–CDH
A6C31	0160–2257	6	C:FXD CER 10 PF 5% 500VDCW	72982	301–000–COHO–100J
A6C32	0160–2257		C:FXD CER 10 PF 5% 500VDCW	72982	301–000–COHO–100J
A6C33	0160–3567		C:FXD CER 10.0 PF 5% 100VDCW	72982	8101–100–COG–100J
A6C34	0160–3567		C:FXD CER 10.0 PF 5% 100VDCW	72982	8101–100–COG–100J
A6C35	0121–0061	2	C:VAR CER 5.5–18 PF NP0	72982	538–011A 5.5–18
A6C36	0121–0061		C:VAR CER 5.5–18 PF NPO	72982	538–011A 5.5–18
A6C37	0160–3451		C:FXD CER 0.01 UF +80 –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C38	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C39	0160–2257		C:FXD CER 10 PF 5% 500VDCW	72982	301–000–COHO–100J
A6C40	0140–0190	2	C:FXD MICA 39 PF 5%	72136	RDM15E390J3C
A6C41	0140–0190		C:FXD MICA 39 PF 5%	72136	RDM15E390J3C
A6C42	0121–0467		C:VAR CER 3.0–9.0 PF 100VDCW	72982	511–000–3–9A
A6C43	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C44	0160–3451		C:FXD CER 0.01 UF +80% –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C45	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C46	0160–3451		C:FXD CER 0.01 CER 0.01 UF +80 –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C47	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C48	0160–0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392–PTS
A6C49	0160–3161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392–PTS
A6C50	0160–3451		C:FXD CER 0.01 UF +80 –20% 100VDCW	56289	C0238101F03ZS25–CDH
A6C51	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C52	0160–2257		C:FXD CER 10 PF 5% 500VDCW	72982	301–000–COHO–100J
A6C53	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C54	0160–2201		C:FXD MY 51 PF 300VDCW	72136	RDM15E430J3C
A6C55	0180–0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2–DYS
A6C56	0160–3652		C:FXD CER 4.7 PF 200VDCW	72982	8101–A200–COG–479K
A6C57	0160–0174		C:FXD CER 0.47 UF +80% –20% 25VDCW	56289	5C11B75–CML
A6C58	0160–0174		C:FXD CER 0.47 UF +80% –20% 25VDCW	56289	5C11B75–CML
A6C59	0180–0230		C:FXD ELECT 1.0 UF 10% 50VDCW	56289	150D105X0050A2–DYS
A6C60	0160–3451		C:FXD CER 0.01 UF +80 –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C61	0160–3451		C:FXD CER 0.01 UF +80 –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C62	0180–0228		C: FXD ELECT 22UF 10% 15 VDCW	56289	150D226X9015B2
A6C63	1060–3451		C:FXD CER 0.01 UF +80% –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C64	0160–3451		C:FXD CER 0.01 UF +80 –20% 100VDCW	56289	C023B101F103ZS25–CDH
A6C65	0160–2257		C:FXD CER 10 PF 5% 500VDCW	72982	3001–000–COHO–100J
A6C66	0160–2257		C:FXD CER 10 PF 5% 500VDCW	72982	3001–000–COHO–100J
A6C67	0122–0247		C:VAR CER 10PF 10% 60WV	04713	IN5140
A6C68	0122–0247		C:VAR CER 10PF 10% 60WV	04713	IN5140
A6C69	0160-2652		C: FXD CED 4.7 PF 200 VDCW	28480	0160–2652
A6CR1	1901–0179	4	DIODE:SILICON 15WV	28480	1901–0179
A6CR2	1901–0179		DIODE:SILICON 15WV	28480	1901–0179
A6CR3	1901–0179		DIODE:SILICON 15WV	28480	1901–0179
A6CR4	1901–0179		DIODE:SILICON 15WV	28480	1901–0179
A6CR5	1901–0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR6	1901–0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR7	1901–0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR8	1901–0040		DIODE:SILICON 30MA 30MV	07263	FDG1088
A6E1	1205–0204	3	HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205–0204
A6E2	1205–0204		HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205–0204
A6E3	1205–0204		HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205–0204
A6L1	9100–2285	2	COIL/CHOKE 560 UH 10%	13019	09–A561K
A6L2	9100–2285		COIL/CHOKE 560 UH 10%	13019	09–A561K
A6L3	9100–2251	8	COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L4	9100–2251		COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L5	9100–2267		COIL:FXD RF 18 UH	28480	9100–2267
A6L6	9100–2251		COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L7	9100–2251		COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L8	9100–2251		COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L9	9100–2251		COIL:FXD RF 0.22 UH 10%	28480	9100–2251
A6L10	9170–0029		BEAD:FERRITE	02114	56–590–65A2/A4
A6L11	9170–0029		BEAD:FERRITE	02114	56–590–65A2/A4
A6L12	9170–0029		BEAD: FERRITE	02114	56-590-65A2/A4
A6MP1	0380–0321	2	SPACER:CAPTIVE	00866	0380–0321
A6MP2	0380–0321		SPACER:CAPTIVE	00866	0380–0321
A6Q1	1855–0383	2	TSTR:DUAL FET SI N–CHANNEL	28480	1855–0383
A6Q2	5080–9675	7	TSTR:MATCHED PAIR	28480	5080–9615
A6Q3	5080–9675		TSTR:MATCHED PAIR	28480	5080–9675
A6Q4	1855–0383		TSTR:DUAL FET SI N–CHANNEL	28480	1855–0383
A6Q5	5080–9675		TSTR:MATCHED PAIR	28480	5080–9675
A6Q6	5080–9675		TSTR:MATCHED PAIR	28480	5080–9675
A6Q7	5080–9674		TSTR:MATCHED PAIR	28480	5080–9674
A6Q8	5080–9674		TSTR:MATCHED PAIR	28480	5080–9674
A6Q9	1853–0203	3	TSTR:SI PNP	28480	1853–0203
A6Q10	1853–0203		TSTR:SI PNP	28480	1853–0203
A6Q11	1853–0061	2	TSTR:SI PNP	28480	1853–0061
A6Q12	1853–0061		TSTR:SI PNP	28480	1853–0061
A6Q13	1854–0019	3	TSTR:SI NPN	28480	1854–0019

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6Q14	1853-0203		TSTR:SI PNP	28480	1853-0203
A6Q15	1854-0019		TSTR:SI NPN	28480	1854-0019
A6Q16	1854-0019		TSTR:SI NPN	28480	1854-0019
A6R1	0757-0280	8	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R3	0757-0417	4	R: FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A6R4	0757-0417		R: FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A6R5	0757-0436	4	R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A6R6	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A6R7	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A6R8	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A6R9	0698-3429	2	R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A6R10	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A6R11	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R12	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A6R13	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R14	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A6R15	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R16	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R17	0757-0180	2	R:FXD MET FLM 31.6 OHM 1% 1/8W	28480	0757-0180
A6R18	0757-0180		R:FXD MET FLM 31.6 OHM 1% 1/8W	28480	0757-0180
A6R19	0757-0274	5	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A6R20	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A6R21	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A6R22	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A6R23	0698-7196	8	R:FXD FLM 21.5 OHM 2% 1/8W	28480	0698-7196
A6R24	0698-7196		R:FXD FLM 21.5 OHM 2% 1/8W	28480	0698-7196
A6R25	0698-7196		R:FXD FLM 21.5 OHM 2% 1/8W	28480	0698-7196
A6R26	0698-7196		R:FXD FLM 21.5 OHM 2% 1/8W	28480	0698-7196
A6R27	0757-0419	4	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R28	0757-0419		R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R29	0757-0419		R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R30	0757-0419		R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R31	0757-0409	2	R:FXD MET FLM 274 OHM 1% 1/8W	28480	0757-0409
A6R32	0757-0409		R:FXD MET FLM 274 OHM 1% 1/8W	28480	0757-0409
A6R33	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R34	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R35	2100-2216	1	R:VAR MET FLM 5K OHM 10% LIN 1/8W	28480	2100-2216
A6R36	0757-0418	1	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A6R37	0757-0733	2	R:FXD MET FLM 1100 OHM 1% 1/4W	28480	0757-0733
A6R38	0698-5426	4	R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A6R39	0757-0733		R:FXD MET FLM 1100 OHM 1% 1/4W	28480	0757-0733
A6R40	0698-5426		R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A6R41	0698-3378	4	R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A6R42	0698-7203		R:FXD FLM 42.2 OHM 2% 1/8W	28480	0698-7203
A6R43	0698-7203		R:FXD FLM 42.2 OHM 2% 1/8W	28480	0698-7203
A6R44	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A6R45	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A6R46	0698-7203		R:FXD FLM 42.2 OHM 2% 1/8W	28480	0698-7203
A6R47	0698-7203		R:FXD FLM 42.2 OHM 2% 1/8W	28480	0698-7203
A6R48	0698-3378		R:FXD CARBON 51 OHM 5% 1/8W	28480	0698-3378
A6R49	2100-1984	4	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A6R50	2100-1984		R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A6R51	0757-0281	4	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A6R52	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A6R53	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A6R54	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A6R55	0698-7025	2	R:FXD COMP 270 OHM 10% 1/8W	01121	BB 2711
A6R56	2100-1986		R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A6R57	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R58	0698-7025		R:FXD COMP 270 OHM 10% 1/8W	01121	BB 2711
A6R59	2100-1986		R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A6R60	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R61	0757-0720	2	R:FXD MET FLM 243 OHM 1% 1/4W	28480	0757-0720
A6R62	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A6R63	0757-0720		R:FXD MET FLM 243 OHM 1% 1/4W	28480	0757-0720
A6R64	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A6R65	0757-0426	2	R:FXD MET FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A6R66	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R67	0757-0426		R:FXD MET FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A6R68	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R69	0698-5426		R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A6R70	0698-5426		R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A6R71	0684-5621	4	R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A6R72	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R73	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A6R74	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A6R75	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A6R76	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A6R77	0757-0413	2	R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A6R78	0757-0426	4	R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A6R79	0757-0346	4	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A6R80	0757-0413		R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A6R81	0757-0426		R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A6R82	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A6R83	0698-0083	2	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R84	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A6R85	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A6R86	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R87	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R88	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R89	0757-0394	4	R:FXD FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A6R90	0757-0394		R:FXD FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A6R91	0698-0085	2	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A6R92	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0697-0085
A6R93	0757-0449	1	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6R94	0698-7212		R:FXD FLM 100 OHM 2% 1/8W	28480	0698-7212
A6R95	0698-7212		R:FXD FLM 100 OHM 2% 1/8W	28480	0698-7212
A6R96	0757-0739	1	R:FXD MET FLM 2.00K OHM 1% 1/4W	28480	0757-0739
A6R97	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A6R98	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R99	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6R100	0757-0401	4	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6R101	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6R102	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R103	0698-0083	2	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R104	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R105	0757-0284	2	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A6R106	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A6R107	0757-0811	1	R:FXD MET FLM 392 OHM 1% 1/2W	28480	0757-0811
A6R108	0757-0159	5	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A6R109	0698-4037	2	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A6R110	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A6R111	0757-0421	2	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A6R112	0757-0421		R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A6R113	0698-7028	2	R:FXD COMP 27 OHM 10% 1/8W	01121	BB 2701
A6R114	2100-1984		R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A6R115	0698-7028		R:FXD COMP 27 OHM 10% 1/8W	01121	BB 2701
A6R116	0757-0806	2	R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0806
A6R117	0757-0417	3	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A6R118	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A6R119	0698-3404	1	R:FXD MET FLM 383 OHM 1% 1/2W	28480	0698-3404
A6R120	0757-0814		R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A6R121	2100-1984		R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A6R122	0757-0424		R:FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A6R123	0757-0424		R:FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A6R124	0757-0422	2	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A6R125	0757-0406	1	R:FXD MET FLM 182 OHM 1% 1/8W	28480	0757-0406
A6R126	0757-0411	1	R:FXD MET FLM 332 OHM 1% 1/8W	28480	0757-0411
A6R127	0757-0426		R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A6R128	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R129	0757-0420		R: FXD MET FLM 750 OHMS 1% 1/8W	28480	0757-0420
A6R130	0698-7203	1	R:FXD FLM 42.2 OHM 1% 1/8W	28480	0698-7203
A6R131	0698-4037		R: FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A6RT1	0837-0035	1	THERMISTOR:DISC TYPE	89473	1D1617
A6U1	5081-3004	2	IC:CONTROL	28480	5081-3004
A6U2	5081-3004		IC:CONTROL	28480	5081-3004
A6VR1	1902-3104	2	DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A6VR2	1902-3104		DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A6VR3	1902-0048	2	DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6VR4	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6VR5	1902-0783	1	DIODE:BREAKDOWN 16.2V 5%	28480	1902-0783
A6VR6	1902-3048	1	DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A6XA	1251-1556	100	CONNECTOR:SINGLE CONTACT	00779	2-330808-8
A7	01805-66510	1	BOARD ASSY:MAIN AMPLIFIER	28480	01805-66510
A7C1	0160-3451	7	C:FXD CER .01 UF 100VDCW	56289	C023B101F103Z525-CD
A7C2	0160-3557	1	C:FXD CER 0.01 UF 20% 200VDCW	72982	8121-200-651-103M
A7C3	0160-2261	1	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A7C4	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A7C5	0121-0443	1	C:VAR CER 3-9 PF 160VDCW	28480	0121-0443

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7C6	0150-0115	1	C:FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K
A7C7	0160-3647	1	C:FXD CER 22 PF 5% 100VDCW	72982	8111-A112-C0G-220J
A7C8	0140-0208	1	C:FXD MICA 680 PF 5%	72136	RDM15F681J3C
A7C9	0160-2260		C:FXD CER 13 PF 5% 500VDCW	72982	301-000-C0G0 130J
A7C10	NOT ASSIGNED				
A7C11	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C12	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A7C13	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C14	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C15	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A7C16	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A7C17	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C18	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C19	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C20	0160-3652		C: FXD CER 4.7 PF 200 VDCW	28480	0160-3652
A7CR1	1901-0535	2	DIODE:HYBRID HOT CARRIER	28480	1901-0535
A7CR2	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR5	1901-0040		DIODE:SILICON 30WV	07263	FDG1088
A7CR6	1901-0040		DIODE:SILICON 30WV	07263	FDG1088
A7E1	0360-1560	4	TERMINAL PIN:BRASS	28480	0360-1560
A7L1	9100-2251		COIL:FXD RF 0.22 UH 10%	28480	9100-2251
A7L2	9100-2251		COIL:FXD RF 0.22 UH 10%	28480	9100-2251
A7R1	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R2	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R3	0757-0446	1	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A7R4	2100-2216	1	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A7R5	2100-2030	1	R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A7R6	2100-2061	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
A7R7	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A7R8	2100-1772	2	R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A7R9	0757-0734	1	R:FXD MET FLM 1.21K OHM 1%/1/4W	28480	0757-0734
A7R10	0698-7209	2	R:FXD FLM 75 OHM 2% 1/8W	28480	0698-7209
A7R11	0698-7209		R:FXD FLM 75 OHM 2% 1/8W	28480	0698-7209
A7R12	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A7R13	2100-1772		R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A7R14	0698-3152	2	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A7R15	0698-3152		R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A7R16	0757-0426		R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A7R17	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A7R18	0757-0806		R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0806
A7R19	0698-3443	1	R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A7R20	0757-0276	2	R:FXD MET FLM 61.9 OHM 1% 1/8W	28480	0757-0276
A7R21	0757-0276	1	R:FXD MET FLM 61.9 OHM 1% 1/8W	28480	0757-0276
A7U1	5081-3005	1	IC:SEALED PACKAGE	28480	5081-3005
A7VR1	1902-3139	1	DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A7VR2	1902-3097	1	DIODE BREAKDOWN:5.23V 2%	28480	1902-3097
A7XA	1251-1556		CONNECTOR:SINGLE CONTACT	00779	2-330808-8
A8	01805-66508	1	BOARD ASSY:OUTPUT	28480	01805-66508
A8C1	0121-0466	11	C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A8C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A8C3	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A8C4	0160-2240	1	C:FXD CER 2.0 PF 500VDCW	72982	301-000-C0K0-209C
A8R1	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R2	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R3	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R4	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A9	01805-61605	1	CABLE ASSY:DELAY LINE	28480	01805-61605
A10	01805-63401	1	ATTENUATOR ASSY:CHANNEL "A"	28480	01805-63401
A10J1	5020-0593	1	CONNECTOR:BNC	28480	5020-0593
A10E1	1250-0051	1	CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
A10S1			NOT SEPARATELY REPLACEABLE		
A10S2			NOT SEPARATELY REPLACEABLE		
A10A1	5081-3003	2	ATTENUATOR SUBSTRATE ASSY	28480	5081-3003
A10A1C1	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A10A1C2	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A10A1C3	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A10A1C4	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A10A1C5	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A10A1C6	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A10A1C7	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A10A1C8	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A10A1C9	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A10A1C10	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A11	01805-63402	1	ATTENUATOR ASSY:CHANNEL "B"	28480	01805-63402

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11J1	5020-0593		CONNECTOR:BNC	28480	5020-0593
A11E1	1250-0051		CONTACT:RF CONNECTOR BNC SERIES	02660	31-2109
A11S1			NOT SEPARATELY REPLACEABLE		
A11S2			NOT SEPARATELY REPLACEABLE		
A11A1	5081-3003		ATTENUATOR SUBSTRATE ASSY	28480	5081-3003
A11A1C1	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A11A1C2	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A11A1C3	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A11A1C4	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A11A1C5	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A11A1C6	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A11A1C7	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A11A1C8	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A
A11A1C9	0121-0466		C:VAR CER 1.0 TO 3.0 PF 100VDCW	72982	511-000-1-3A
A11A1C10	0121-0467		C:VAR CER 3.0-9.0 PF 100VDCW	72982	511-000-3-9A

Table 6-3. List of Manufacturers' Codes

MFR. NO.	MANUFACTURE NAME	ADDRESS	ZIP CODE
00000	U. S. A. COMMON	ANY SUPPLIER OF U. S. A.	17101
00779	AMP, INC.	HARRISBURG, PA.	53204
01121	ALLEN BRADELY, CO.	MILWAUKEE, WIS.	85008
04713	MOTOROLA, INC.	PHOENIX, ARIZONA	94040
07263	FAIRCHILD CAMERA & INST., CORP.	MOUNTAIN VIEW, CAL.	67213
13019	AIRCO SUPPLY CO., INC.	WITCHITA, KANSAS	01247
56289	SPRAGUE ELECTRIC, CO.	NORTH ADAMS, MASS.	60153
71744	CHICAGO MINIATURE LAMP WORKS	CHICAGO, ILL.	06226
71785	CINCH MFG., CO.	CHICAGO, ILL.	16512
72136	ELECTRO MOTIVE MFG., CO.	WILLIMANTIC, CONN.	20006
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	ERIE, PA.	10544
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON, D. C.	
98291	SEALECTRO, CORP.	MAMARONECH, N. Y.	

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Description of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either in the title page or in table 7-1, refer to an enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA corrections.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1205A	1

CHANGE 1

Table 6-2,

A9: Change to HP Part Number 01805-61601; Qty 1; CABLE ASSY: DELAY LINE; Mfr Code 28480, Mfr Part Number 01805-61601.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information (and MANUAL CHANGES sheet information, if applicable). When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

MANUAL CHANGES

MODEL 1805A

DUAL CHANNEL VERTICAL AMPLIFIER

Manual Serials Prefixed: 1233A
Manual Printed: SEPT 1972

Make all changes listed below as Errata. Check the following table for your instrument serial prefix and/or serial number and make listed change(s) to the manual:

Serial Prefix or Number	Make Changes	Serial Prefix or Number	Make Changes
1239A	1	1347A	1 thru 5
1244A	1, 2	1409A	1 thru 6
1306A	1, 2, 3		
1338A	1, 2, 3, 4		

ERRATA

Page 1-1, Paragraph 1-11,
10004C: Change to 10014A.

Page 1-2, Table 1-1. Specifications,
DEFLECTION FACTOR:
Accuracy: ±2%. Should read Attenuator Accuracy: ±2%.
A + B OPERATION:
Differential Input (A — B) Common Mode:
Last sentence should read: Cmr at least 20 dB at 50 MHz for common-mode signals of 6 divisions or less.
INPUT RC:
50 ohm: 50 ohms ±2%.
VSWR: Change to read: <1.2:1 at 100 MHz on all ranges.

Page 3-2, Paragraph 3-28,
10004C: Change to 10014A.

Page 5-0, Table 5-1,
10:1 Probe: Change Recommended Model to 10014A.

Page 5-6, Table 5-4,
Change to read: A-B (dB) >21 dB; Reflection Coefficient <0.09; VSWR <1.2:1.

Page 5-8, Paragraph 5-28,
Add after step o.

Note

Gain in the 50Ω position may differ from the gain in the AC and DC position. This difference will be proportional to the amount of resistance in the input lead (1 ohm will cause a 2% variation). If a greater degree of accuracy in the 50Ω position is required perform the following steps:

p. Set Model 1805A front-panel controls as shown in paragraph 5-8, except for following:
Coupling A and B 50Ω
q. Connect an accurate ±30 mVdc signal to channel A INPUT.

Note

Ensure a minimum of resistance in input lead.

r. Adjust front-panel VOLTS/DIV CAL R6 for 6-division display.
s. Disconnect test equipment.

Table 6-2, Replaceable Parts,
MP3: Change to HP Part No. 5040-5996, LEVER: COUPLING, Mfr. Code 28480, Mfr. Part No. 5040-5996.
Delete: MP4.
R7 and R8: Change to HP Part No. 2100-3277, QTY 2, R: VAR WW 5K OHMS 20% 2W, Mfr. Code 28480, Mfr. Part No. 2100-3277.
A1S1: Change HP and Mfr. Part Nos. to 3101-0534.
A6C56: Change to HP Part No. 0160-3565, C: FXD CER 6.8 PF 100 VDCW, Mfr. Code 72982, Mfr. Part No. 8101-100-COG-689J.
Add: A6C69 through A6C72, HP Part No. 0160-3652, C: FXD CER 4.7 PF 0.5% 200 VDCW (FACTORY SELECTED VALUE), Mfr. Code 72982, Mfr. Part No. 8101-A200-COG-479K.
A6Q2: Change Mfr. Part No. to 5080-9675.
A6Q2, A6Q3, A6Q5, A6Q6: Change Description to read: TSTR: MATCHED QUAD.
Δ A6R38: Change to HP Part No. 0698-7931, R: FXD COMP 1500 OHM 10% 1/8W, Mfr. Code 01121, Mfr. Part No. BB 1521.
Δ A6R40: Change to HP Part No. 0698-7931, R: FXD COMP 1500 OHM 10% 1/8W, Mfr. Code 01121, Mfr. Part No. BB 1521.

14 March 1974
Δ = Latest additions to this change sheet.
This change sheet supersedes all prior change sheets for this manual.

ERRATA (Cont'd)

Table 6-2 (Cont'd),

Δ A6R69: Change to HP Part No. 0698-7931, R: FXD COMP 1500 OHM 10% 1/8W, Mfr. Code 01121, Mfr. Part No. BB 1521.

Δ A6R70: Change to HP Part No. 0698-7931, R: FXD COMP 1500 OHM 10% 1/8W, Mfr. Code 01121, Mfr. Part No. BB 1521.

Δ A6R71: Change to HP Part No. 0684-1221, R: FXD COMP 1200 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1221.

Δ A6R72: Change to HP Part No. 0684-1221, R: FXD COMP 1200 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1221.

Δ A6R73: Change to HP Part No. 0684-1221, R: FXD COMP 1200 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1221.

Δ A6R75: Change to HP Part No. 0684-1221, R: FXD COMP 1200 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1221.

A6R78, A6R81, A6R83, A6R87: Change to HP Part No. 0757-0424, R: FXD MET FLM 1.10K OHM 1% 1/8W, Mfr. Code 28480, Mfr. Part No. 0757-0424.

A7C4: Add to description, FACTORY SELECTED VALUE–MAY BE OMITTED BY TEST.

A7C6: Change to HP Part No. 0160-2679, C: FXD CER 30 PF 5% 500 VDCW, Mfr. Code 72982, Mfr. Part No. 308-000-COGO-300J.

Table 6-2 (Cont'd),

A7C7: Add to description, FACTORY SELECTED VALUE–MAY BE OMITTED BY TEST.

A8C4: Add to description, FACTORY SELECTED VALUE–MAY BE OMITTED BY TEST.

Page 8-13/8-14, Schematic 2,

ΔA6C69: Add asterisk to symbol.

ΔAdd: *A6C70 in parallel with R76. Value to A6C70 is 4.7 pF.

Δ Add: *A6C71 (4.7 pF) across A6R61.

Δ Add: *A6C72 (4.7 pF) across A6R63.

A6R78, A6R81, A6R83, A6R87: Change value to 1100.

Δ A6R69: Change value to 1500.

Δ A6R73: Change value to 1200.

Δ A6R38: Change value to 1500.

Δ A6R71: Change value to 1200.

Δ A6R70: Change value to 1500.

Δ A6R75: Change value to 1200.

Δ A6R40: Change value to 1500.

Δ A6R72: Change value to 1200.

Page 8-15, Schematic 3,

C56: Change value to 6.8.

Page 8-17/8-18, Schematic 4,

A7C4: Add asterisk.

A7C6: Change value to 30.

A7C7: Add asterisk.

A8C4: Add asterisk.

CHANGE 1

Page 6-3, Table 6-2,
Add: A3C13; HP Part No. 0140-0198; QTY 1; C: FXD MICA 200 PF 5%; Mfr. Code 72136; Mfr. Part No. RDM15F201J3C.

Page 6-7, Table 6-2,
A6U1: Change to HP Part No. 5081-3018; QTY 2; IC: CONTROL; Mfr. Code 28480; Mfr. Part No. 5081-3018.

Page 6-7, Table 6-2 (Cont'd),
A6U2: Change to HP Part No. 5081-3018; IC: CONTROL; Mfr. Code 28480; Mfr. Part No. 5081-3018.

Page 8-23/8-24, Figure 8-19,
Add: A3C13, 200 PF capacitor between collector of A3Q6 and collector of A3Q7.

CHANGE 2

Page 6-3, Table 6-2,
Add: A1MP1; HP Part No. 3131-0252; qty 12; SPACER: STANDOFF; Mfr. Code 28480; Mfr. Part No. 3131-0252.
A1S1: Change to HP Part No. 3101-0534; qty 1; PUSHBUTTON SWITCH ASSY; Mfr. Code 28480; Mfr. Part No. 3101-0534.

Page 6-3, Table 6-2 (Cont'd),
Add: A2MP1; HP Part No. 3131-0252; SPACER: STANDOFF; Mfr. Code 28480; Mfr. Part No. 3131-0252.
A2S1: Change to HP Part No. 3101-0533; qty 1; PUSHBUTTON SWITCH ASSY; Mfr. Code 28480; Mfr. Part No. 3101-0533.

CHANGE 3

Page 6-3, Table 6-2,
Add: A2R18, HP Part No. 0757-0814; R: FXD MET FLM 511 OHM 1% 1/2W; Mfr. Code 28480; Mfr. Part No. 0757-0814.
Add: A2VR2; HP Part No. 1902-0041; DIODE: BREAKDOWN 5.11V 5%; Mfr. Code 04713; Mfr. Part No. SZ10939-98.

Page 8-19/8-20, Schematic 5,
R4 and R5: Change color code (948) of wires to chassis resistors R4 and R5 to color code (902). Change color code (902) of wires to chassis resistors R4 and R5 to color code (948).

Page 8-21, Schematic 6,
Make corrections indicated in figure 1.

CHANGE 4

Page 6-2, Table 6-2,
A1: Change HP and Mfr Part Nos. to 01805-66511.
A9: Change HP and Mfr Part Nos. to 01805-61606.
MP13: Change HP and Mfr Part Nos. to 01805-00206.
R1: Change to HP Part No. 0811-0625, R: FXD WW 140 OHM 1% 7.5W, Mfr Code 28480, Mfr Part No. 0811-0625.
A8: Change HP and Mfr. Part Nos. to 01805-66512.
Add: A8C5, HP Part No. 0160-3451, C: FXD CER 0.01 UF +80—20% 100 VDCW, Mfr. Code 56289, Mfr. Part No. C023B101F103ZS25—CD.

Page 6-2, Table 6-2, (Cont'd)
Add: W2, HP Part No. 01805-61603, CABLE ASSY: FRONT PANEL, Mfr. Code 28480, Mfr Part No. 01805-61603.
Add: W3, HP Part No. 01805-61604, CABLE ASSY: OUTPUT, Mfr Code 28480, Mfr Part No. 01805-61604.

Schematic 4,
Add: A8C5 (0.01 UF) in parallel with A8C2.

CHANGE 5

Page 6-2, Table 6-2,
MP19: Change HP Part No. and Mfr. Part No. to 01805-60102.

Page 6-2, Table 6-2 (Cont'd),
MP24: Change HP Part No. and Mfr. Part No. to 01805-04103.

Δ CHANGE 6

Table 6-2, Replaceable Parts,

A6C33: Change to HP Part No. 0160-3565, C: FXD CER 6.8 PF 100VDCW, Mfr. Code 72982, Mfr. Part No. 8101-100-COG-689J.

A6C34: Change to HP Part No. 0160-3565, C: FXD CER 6.8 PF 100VDCW, Mfr. Code 72982, Mfr. Part No. 8101-100-COG-689J.

Add: A6L13 and A6L14, HP Part No. 9170-0029, CORE: FERRITE BEAD (FACTORY SELECTED), Mfr. Code 02114, Mfr. Part No. 56-590-65A2/4A.

A7C7: Change to HP Part No. 0160-3567, C: FXD CER 10.0 PF 5% 100VDCW (FACTORY–SELECTED VALUE), Mfr. Code 72982, Mfr. Part No. 8101-100-COG-100J.

Table 6-2, Replaceable Parts (Cont'd),

A8C4: Change to HP Part No. 0160-2236, C: FXD CER 1.0 PF 500VDCW (FACTORY–SELECTED VALUE), Mfr. Code 72982, Mfr. Part No. 301-000-COKO-109C.

Schematic 2,

A6C33: Change value to 6.8.

A6C34: Change value to 6.8.

Add: *A6L13 (BEAD) in base of A6Q7.

Add: *A6L14 (BEAD) in base of A6Q8.

Schematic 4,

A7C7: Add asterisk to symbol and change value to 10.0.

A8C4: Add asterisk to symbol and change value to 1.0.

Revision A

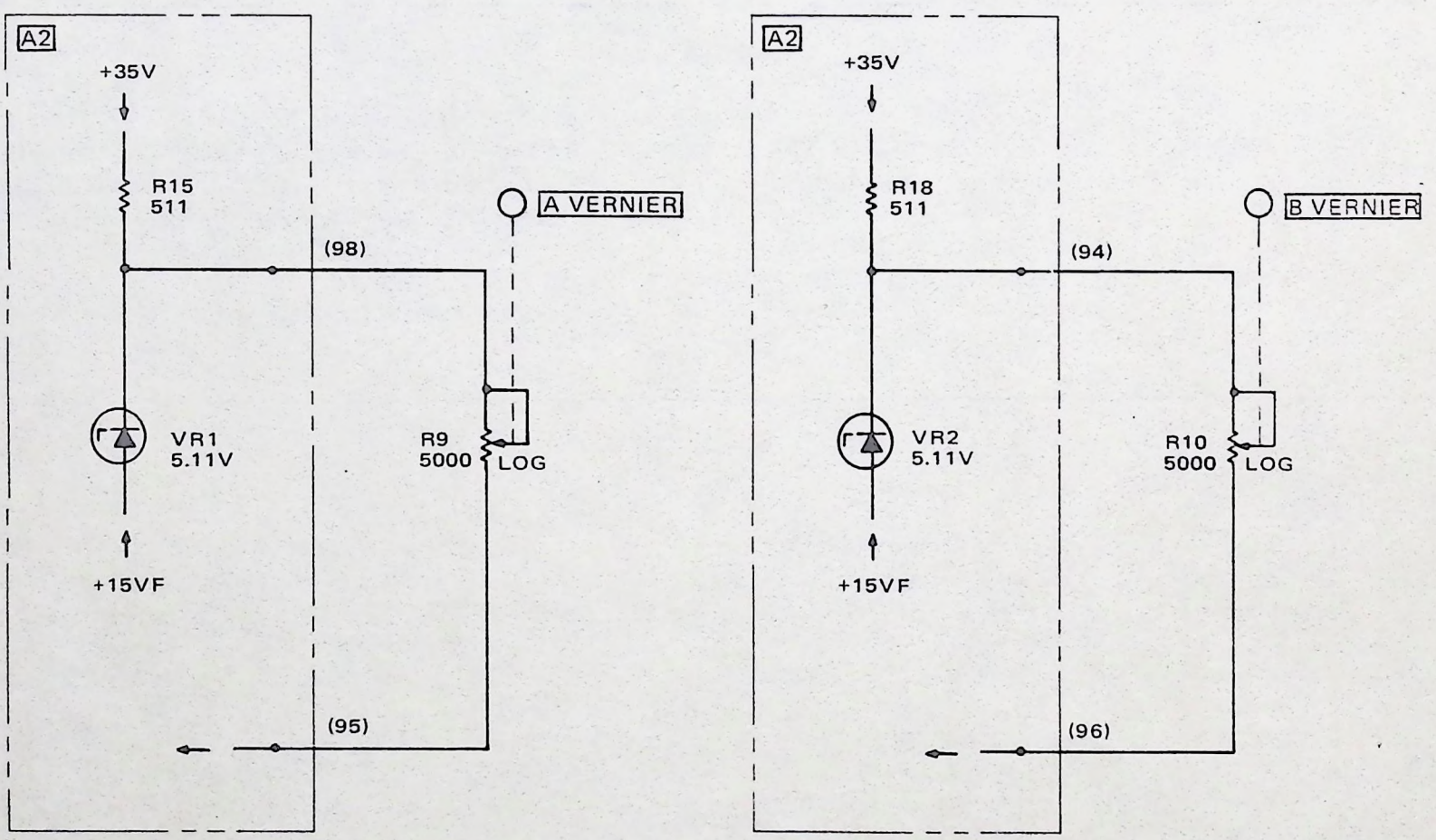


Figure 1

Revision B

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component-identification illustrations, test conditions, and troubleshooting information for this instrument. Figure 8-4 is a troubleshooting block diagram which provides a guide to locating possible problems. Table 8-1 defines symbols and conventions used on the schematics. A disassembly procedure for attenuator repair and replacement is also contained in this section.

Note

Except for the output amplifier, all amplifiers in the Model 1805A are current amplifiers. This manual does not contain waveform photographs because current waveforms will not aid in troubleshooting the Model 1805A.

8-3. SCHEMATICS.

8-4. Schematics are printed on foldout pages for easy reference to the text and figures in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies. Non MIL-standard symbols and conventions used in the schematics are defined in table 8-1.

8-5. The schematics are numbered in sequence with a bold number in a box at the lower right-hand corner of each page. These numbers are used to cross reference signal connections between schematics. At each circuit breaking point, a notation is made of either a signal number or signal name and the schematic number (in bold type) to which the signal is going. To find the source or destination of any point on a given schematic, turn to the schematic referred to by the schematic number and find the name or number of the signal in question.

8-6. A table on each schematic lists all components shown on the schematic. Components which have been deleted from the schematic have their reference designators listed below the table.

8-7. All components within the shaded areas of a schematic are physically located on etched circuit boards. Components not physically located on an etched circuit board are shown in the unshaded areas of the schematic.

8-8. REFERENCE DESIGNATIONS.

8-9. The unit system of reference designations used in this manual is in accordance with the provisions of USA Standard Y32.16—1968, Reference Designations for Electrical and Electronics Parts and Equipments, dated March 1, 1968. Minor variations from the standard, due to design and manufacturing practices, may be noted.

8-10. Each electrical component is assigned a class letter and number. This letter-number combination is the basic reference designation. Components that are not part of an assembly have only the basic reference designation. Components which are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly of which the component is a part (resistor R23 on assembly A1 is called A1R23).

8-11. Assemblies are numbered consecutively. If an assembly reference designation is assigned and later deleted, that number is not reused.

8-12. COMPONENT LOCATIONS.

8-13. Locations of components on assemblies and subassemblies are illustrated in photos adjacent to the schematics. Since the schematics are drawn to show function, portions of a particular assembly may appear on several different schematics. The component-location photo is printed next to the schematic that shows most of the circuitry on the assembly. Components located on the chassis are identified in figure 8-3. The locations of all adjustments are shown in Section V.

8-14. REPAIR AND REPLACEMENT.

8-15. The following paragraphs provide procedures for removal and replacement of assemblies, subassemblies, and components in the Model 1805A. Special servicing instructions for the printed circuit boards are covered later in this section. Section VI provides a detailed parts list for use in ordering replacement parts.

8-16. OUTPUT TRANSISTOR REMOVAL.

8-17. Output transistors Q1 through Q4 (figure 8-3) are mounted on stand-off insulators and are held in place by spring clips. The transistor leads pass through the stand-off insulators and are soldered directly to

the back side of output amplifier assembly A8. To remove the output transistors, proceed as follows:

a. Disconnect spring clip holding transistor.

b. Unsolder transistor leads one at a time and clean holes with desoldering tool.

c. Remove transistor.

8-18. ATTENUATOR REMOVAL.

8-19. The following steps provide procedures for removal and replacement of attenuators. Figure 8-3 identifies the components.

a. Remove preamplifier shield.

b. Remove support strut.

c. Unsolder attenuator output leads from A6Q1 and A6Q4.

d. Remove two screws, H1, securing input end of preamplifier board A6.

e. Remove two screws, H2, securing top of front panel assembly.

f. Remove screw, H3, securing side of front panel assembly.

g. Remove VERT OUT J1 connector from front panel.

h. Remove front panel assembly by pulling forward on front panel and working switch boards, A1 and A2, from control board A3.

i. Remove VOLTS/DIV knob (MP20, MP8, and MP7).

j. Remove INPUT connectors A10J1 and A11J1.

k. Remove attenuators from front panel assembly.

8-20. ATTENUATOR REPAIR.

8-21. Attenuator assemblies A10 and A11 use a thick-film substrate type circuit board with cam-actuated spring switch contacts. Because of the advanced design of the attenuators, it is best to send the attenuators to the nearest HP Sales/Service Office for repair. The following paragraphs provide instructions for disassembly, assembly, and care while handling.

CAUTION

Always wear protective cotton gloves (such as HP part number 8650-0030) while handling the thick-film substrate. The substrate is extremely susceptible to conduction paths caused by finger prints.

8-22. The only repairs that should be attempted, by other than factory personnel, is replacement of the thick-film substrate. No other components are replaceable.

8-23. Attenuator Disassembly.

a. Set coupling switch to GND.

b. Set VOLTS/DIV to .005.

c. Remove adjustment cover.

d. Unsolder output wire from board assembly A6 and input wire from BNC connector. Use controlled output type soldering iron with tip temperature of 700 degrees.

e. Release substrate by pulling spring retaining clip toward back of attenuator.

f. Tilt substrate about 45 degrees (so contacts clear pushrods).

g. Remove substrate from spring mounting clips by sliding substrate toward attenuator output.

8-24. Attenuator Assembly.

a. Hold substrate with contacts down and input facing BNC connector.

b. Tilt substrate about 45 degrees while sliding it under the ground spring and feeding the input wire into the BNC connector.

c. Verify grounding springs are seated inside adjustment cover channels (figure 8-1).

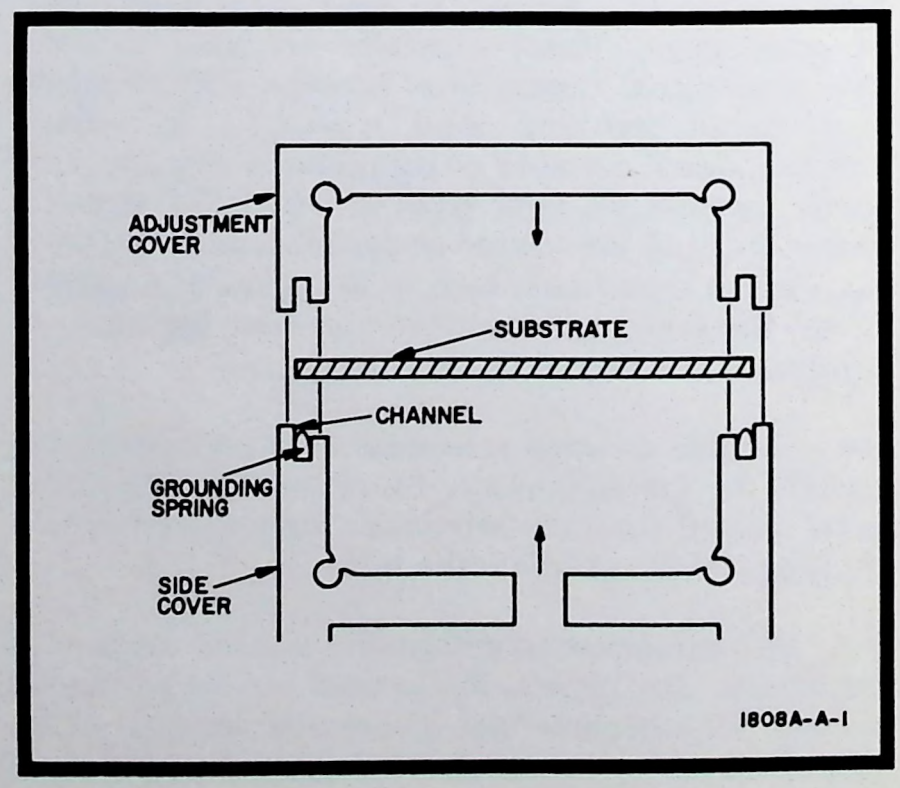


Figure 8-1. Attenuator Assembly

d. Verify substrate is centered in and flush with side cover channels.

e. Solder input wire to BNC connector and output wire to board assembly A6. Use controlled output type soldering iron with tip temperature of 700 degrees.

f. Install adjustment cover.

Note

Slight pressure applied to the adjustment cover may be necessary to align mounting holes.

8-25. CIRCUIT BOARDS.

8-26. The following paragraphs provide information regarding servicing procedures for etched circuit boards.

8-27. BOARD CONNECTIONS.

8-28. Square-pin connectors are identified on circuit boards by the color code of the connecting wires. Connector pins on plugs and jacks are identified by numbers and/or letters. The letters G, I, O, and Q are omitted. Table 8-1 shows the types of board connections used in this instrument.

8-29. CIRCUIT BOARD REMOVAL.

8-30. All circuit boards in this instrument are easily removed for servicing. The Model 1805A has both the plug-in type and the mounted type circuit boards. The following paragraphs describe the removal procedure for each type circuit board.

8-31. Mounted Circuit Board Removal. There are three mounted circuit boards in the Model 1805A: the mother board A4, main amplifier A7 and the output amplifier circuit board A8. Figure 8-3 identifies the components.

8-32. To remove mother board A4, proceed as follows:

a. Perform steps a through h of paragraph 8-19.

b. Remove two screws holding switch board shield MP15.

c. Remove screw holding power supply bracket MP17.

d. Remove two screws holding connector A4P1.

e. Remove two screws holding mother board A4.

f. Disconnect wires from square-pin connectors on circuit board.

g. Unsolder wires (+115 Vac) from A4P1.

h. Remove mother board A4 from Model 1805A chassis.

8-33. To remove main amplifier circuit board A7 and output amplifier circuit board A8, proceed as follows:

a. Disconnect wires from square pins.

b. Unsolder wires connecting A7 to circuit board A8.

c. Remove screws holding circuit board to bracket.

d. Remove circuit board.

Note

When installing circuit board A8, align transistor leads on back side of A8 with Q1 through Q4 transistor leads. Gently push board onto transistor leads until board standoffs contact bracket; then fasten.

8-34. Plug-in Circuit Board Removal. There are five plug-in circuit boards in the Model 1805A; the top switch board A1, bottom switch board A2, control board A3, power supply board A5, and preamplifier board A6.

8-35. To remove top switch board A1 and bottom switch board A2, proceed as follows:

a. Perform steps a through h of paragraph 8-19.

b. Unsolder wires from circuit board.

8-36. To remove control board A3, proceed as follows:

a. Perform steps a through h of paragraph 8-19.

b. Remove two screws holding switch board shield MP15.

c. Remove control board A3 from mother board socket XA3.

8-37. To remove power supply board A5, proceed as follows:

a. Remove two screws holding power supply bracket MP17.

b. Remove power supply board A5 from mother board socket XA5.

8-38. To remove preamplifier board A6, proceed as follows:

a. Remove preamplifier shield.

b. Remove support strut.

c. Unsolder attenuator output leads from A6Q1 and A6Q4.

d. Remove four screws holding preamplifier board A6.

e. Disconnect wires from square pins.

f. Remove preamplifier board A6 from mother board socket XA6.

8-39. SERVICING ETCHED CIRCUIT BOARDS.

8-40. This instrument uses etched circuit boards with plated-through component holes. This allows components to be removed or replaced by unsoldering or soldering from either side of the board. When removing large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information on the repair of etched circuit boards.

8-41. SEMICONDUCTOR REPLACEMENT.

8-42. Figure 8-2 is included to help identify the leads for common shapes and sizes of semiconductor devices. When removing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as was used for the original part.

8-43. INTEGRATED CIRCUIT REPLACEMENT.

8-44. The integrated circuits in this instrument are of the plug-in type. Remove a plug-in IC with a straight pull away from the board.

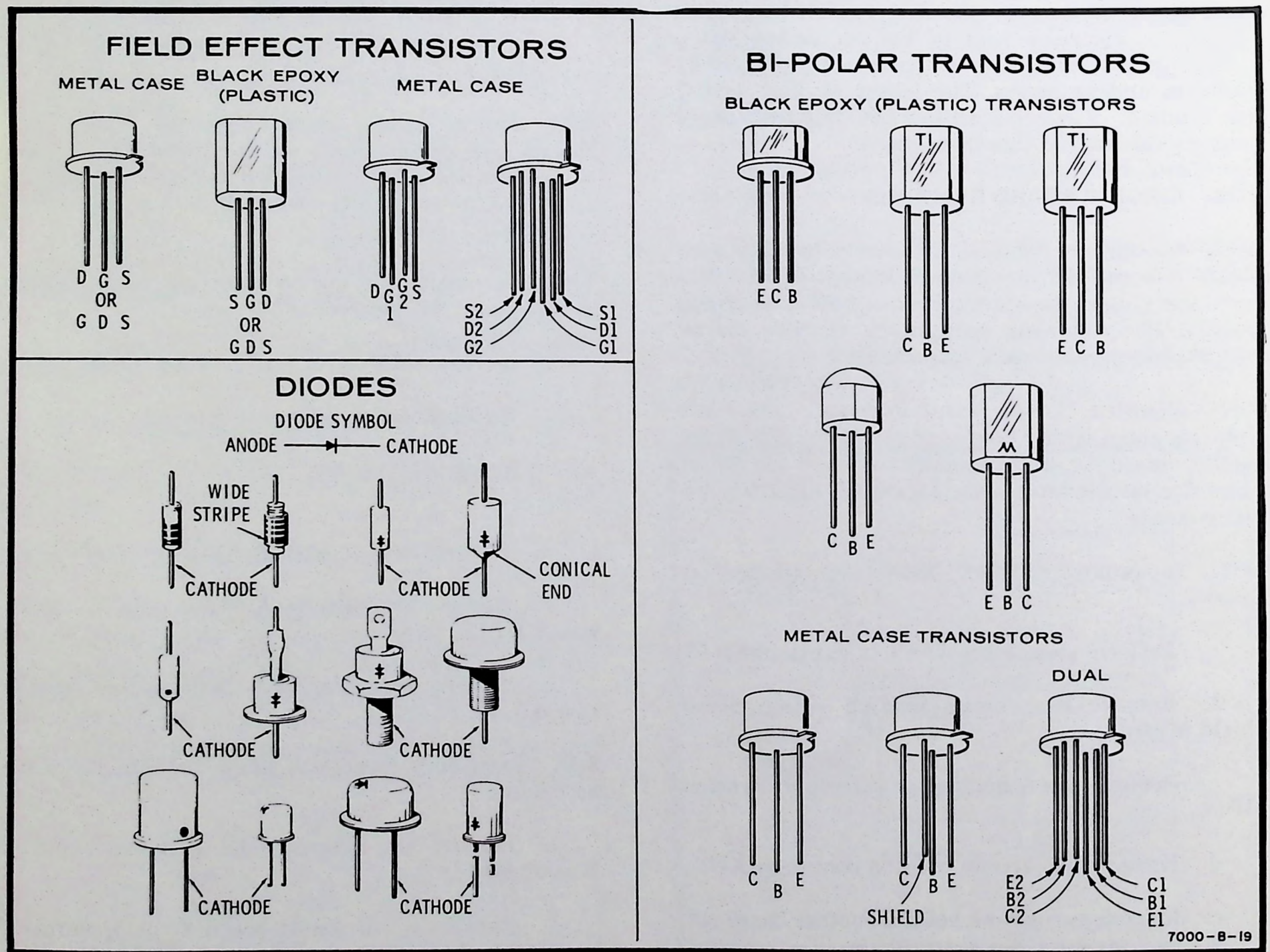


Figure 8-2. Semiconductor Terminal Identification

8-45. When replacing an IC, note the mark or notch used for orientation. The component identification photos and the IC pin-location diagrams of this manual show IC orientation.

8-46. TROUBLESHOOTING.

8-47. The most important prerequisite for successful troubleshooting is understanding how the instrument is designed to operate and correct use of front-panel controls. Suspected malfunctions may be caused by improper control settings or circuit connections such as no vertical display when coupling switch is set to GND. Before doing the test and/or troubleshooting procedures, read Section III (Operation) for an explanation of controls and connectors and general operating considerations, and Section IV (Principles of Operation) for an explanation of circuit theory.

8-48. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that might suggest a source of trouble. Check to see that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check the power supply voltages in the unit. Prior to any extensive troubleshooting, check the external power sources also. Figure 8-4 is a troubleshooting block diagram.

8-49. DC VOLTAGES.

8-50. On some of the schematics, dc voltages are indicated for active components (transistors, etc.). Conditions for making the voltage measurements are listed in a table adjacent to each schematic. Since the conditions for making these measurements may differ from one circuit to another, always check the specific conditions listed adjacent to the schematic.

8-51. TEST POINTS.

8-52. Test points are shown on the schematics with this symbol (◎). Test points correspond to pins protruding from etched circuit boards.

Table 8-1. Schematic Notes

Refer to MIL-STD -15-1A for schematic symbols not listed in this table.

= Etched circuit board

= Front-panel marking

= Rear-panel marking

= Front-panel control

= Screwdriver adjustment

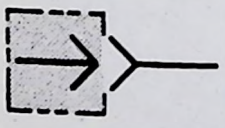
P/O = Part of

CW = Clockwise end of variable resistor

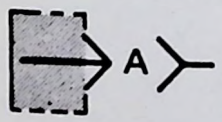
NC = No connection

= Waveform test point (with number)

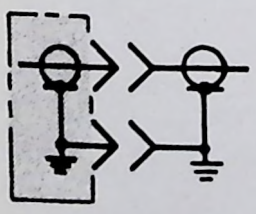
= Common electrical point (with letter) not necessarily ground



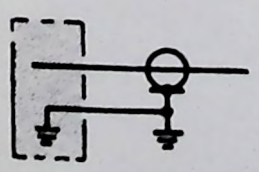
= Single-pin connector on board



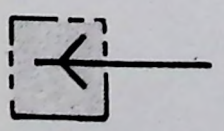
= Pin of a plug-in board (with letter or number)



= Coaxial cable connected to snap-on jack



= Coaxial cable connected directly to board

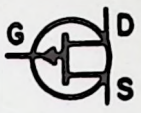


= Wire connected to pressure-fit socket on board

= Main signal path

= Primary feedback path

= Secondary feedback path



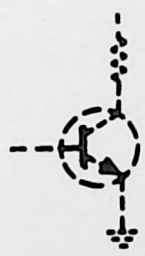
= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode



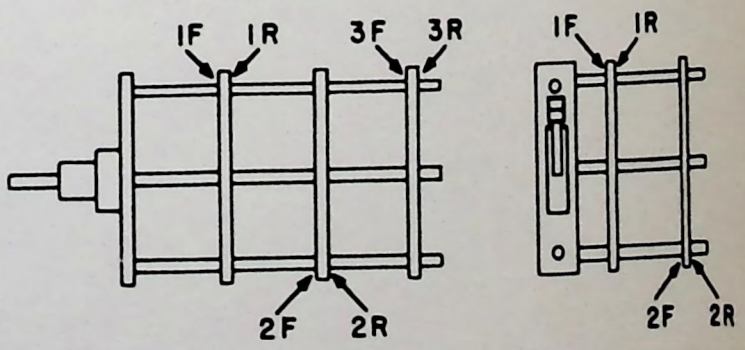
= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(925) = Wire colors are given by numbers in parentheses using the resistor color code

[(925) is wht-red-grn]

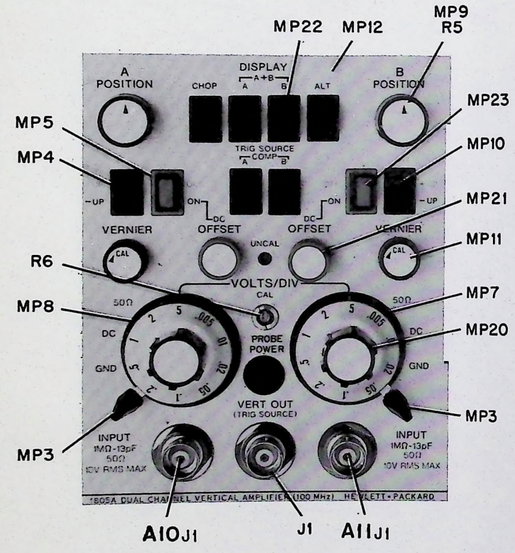
0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

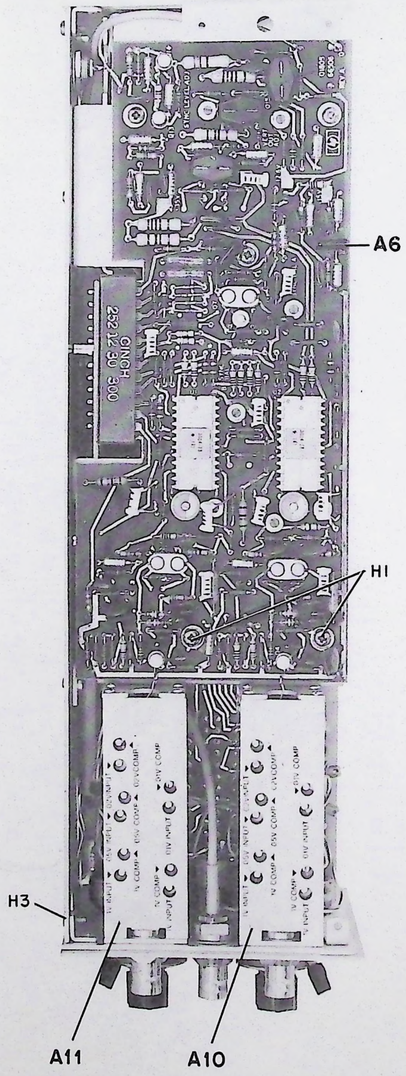
Switch wafers are identified as follows:

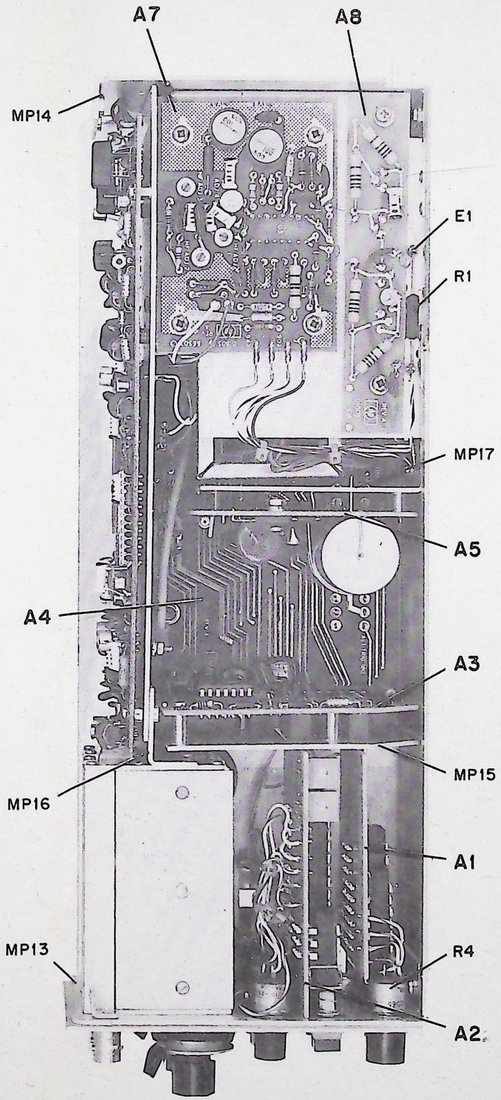


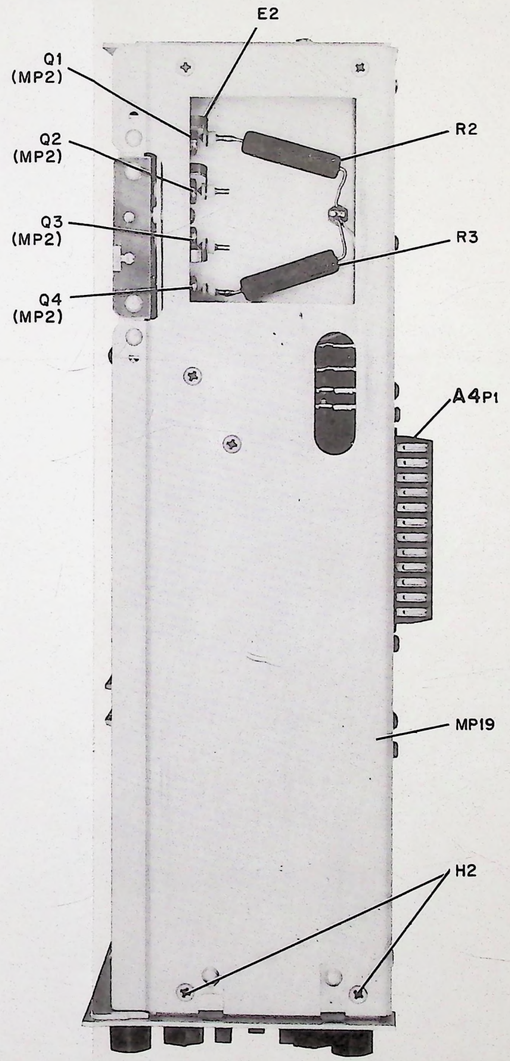
* = Optimum value selected at factory, typical value shown; part may have been omitted.

Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries









1805A-R-16

Figure 8-3.
Chassis Component Location

Table 8-2. Voltage Measurement Conditions

OSCILLOSCOPE

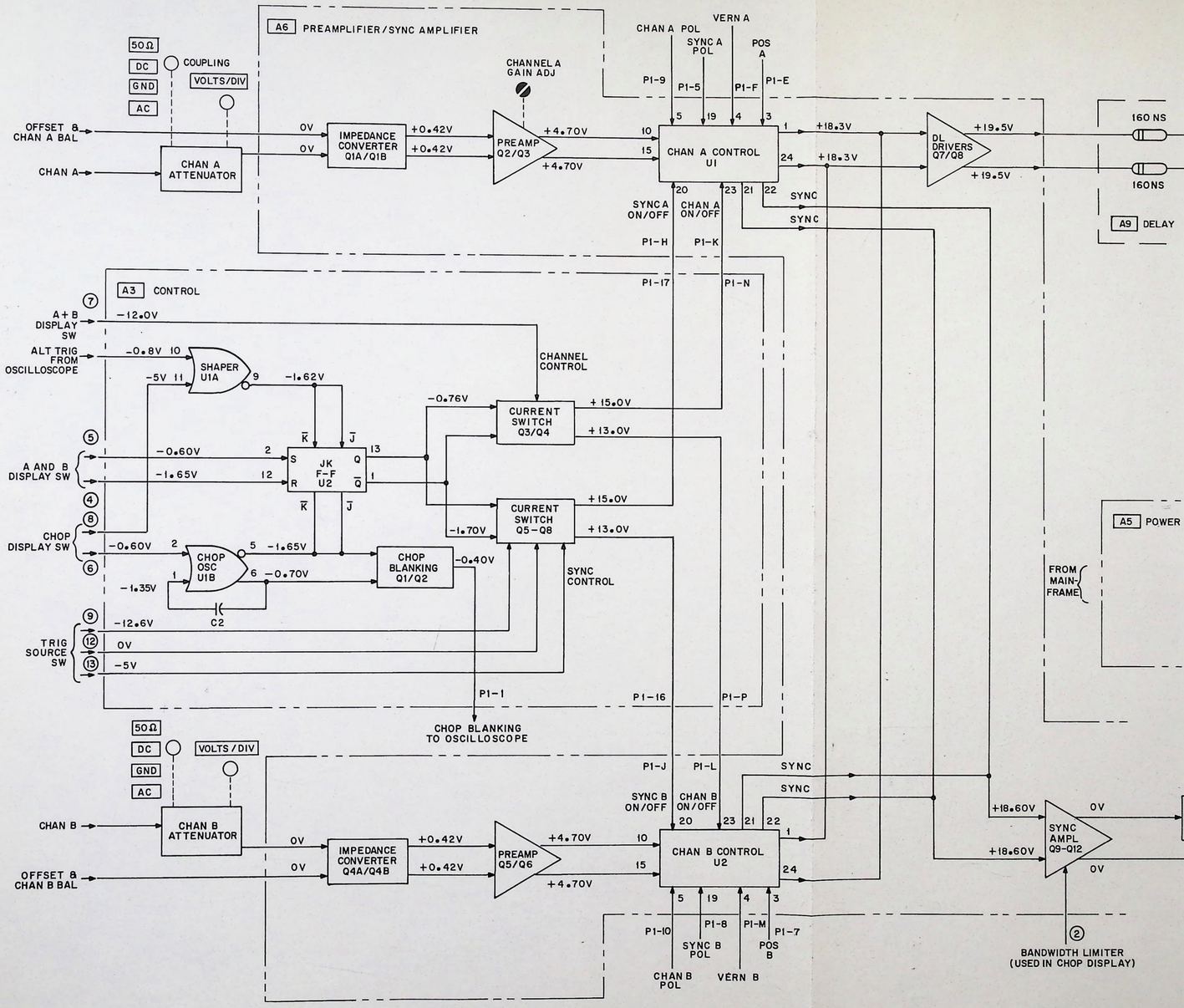
Focus	as necessary
Intensity	as necessary
Horizontal position	as necessary
Mag	X1
Display	Internal

TIME BASE

Time/division	0.5 m/sec
Trigger	Internal
Mode	Auto

MODEL 1805A

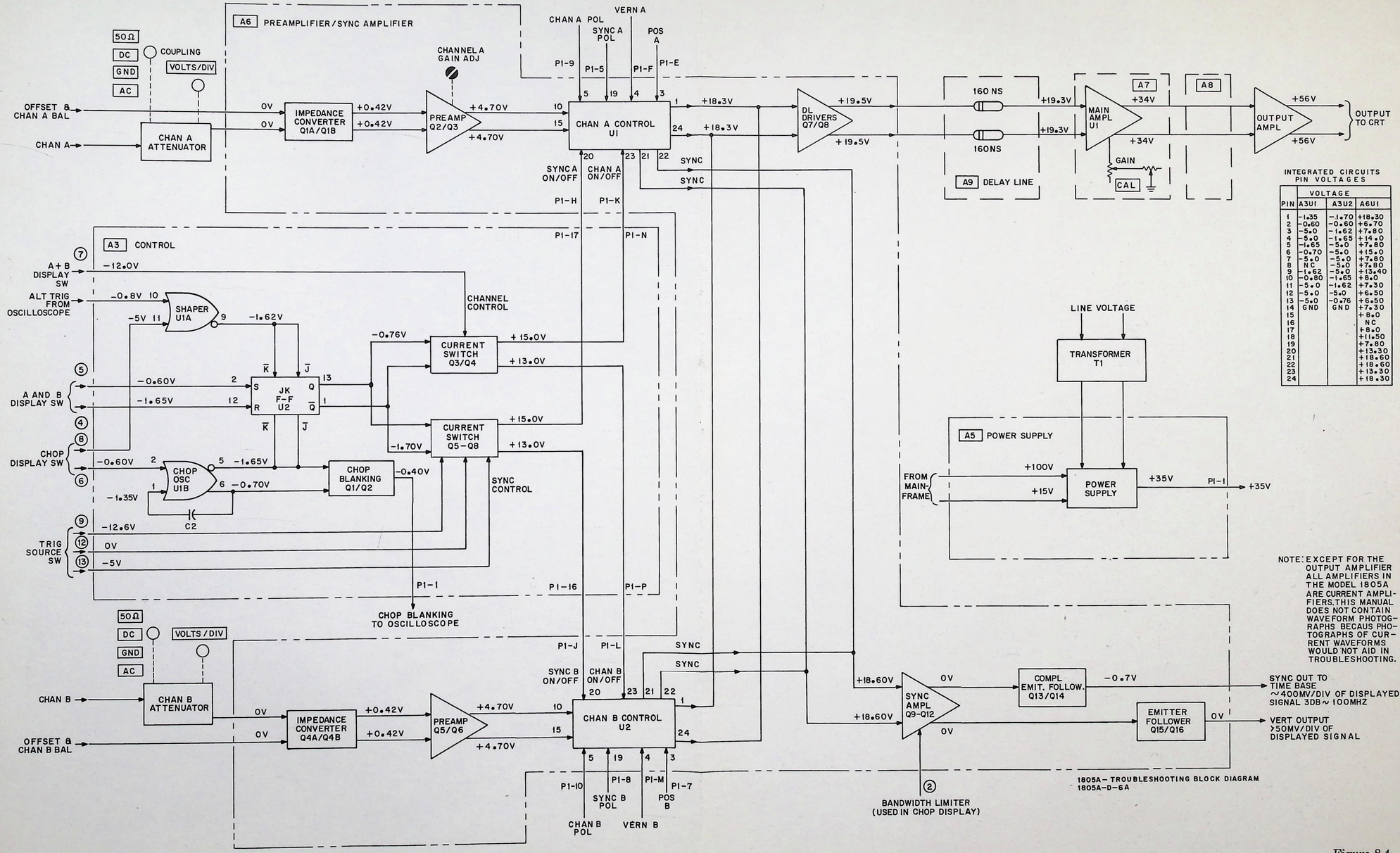
DISPLAY	A
TRIG SOURCE	A
Polarity	+ UP
VOLTS/DIV	.005
VERNIER	CAL
POSITION	as necessary
Coupling	GND



as necessary
as necessary
as necessary
..... X1
..... Internal

... 0.5 m/sec
..... Internal
..... Auto

..... A
..... A
..... + UP
..... .005
..... CAL
as necessary
..... GND



PIN	VOLTAGE A3U1	A3U2	A6U1
1	-1.35	-1.70	+18.30
2	-0.60	-0.60	+6.70
3	-5.0	-1.62	+7.80
4	-5.0	-1.65	+14.0
5	-1.65	-5.0	+7.80
6	-0.70	-5.0	+15.0
7	-5.0	-5.0	+7.80
8	NC	-5.0	+7.80
9	-1.62	-5.0	+13.40
10	-0.80	-1.65	+8.0
11	-5.0	-1.62	+7.30
12	-5.0	-5.0	+6.50
13	-5.0	-0.76	+6.50
14	GND	GND	+7.30
15			+8.0
16			NC
17			+8.0
18			+11.50
19			+7.80
20			+13.30
21			+18.60
22			+18.60
23			+13.30
24			+18.30

Figure 8-4.
Troubleshooting Block Diagram

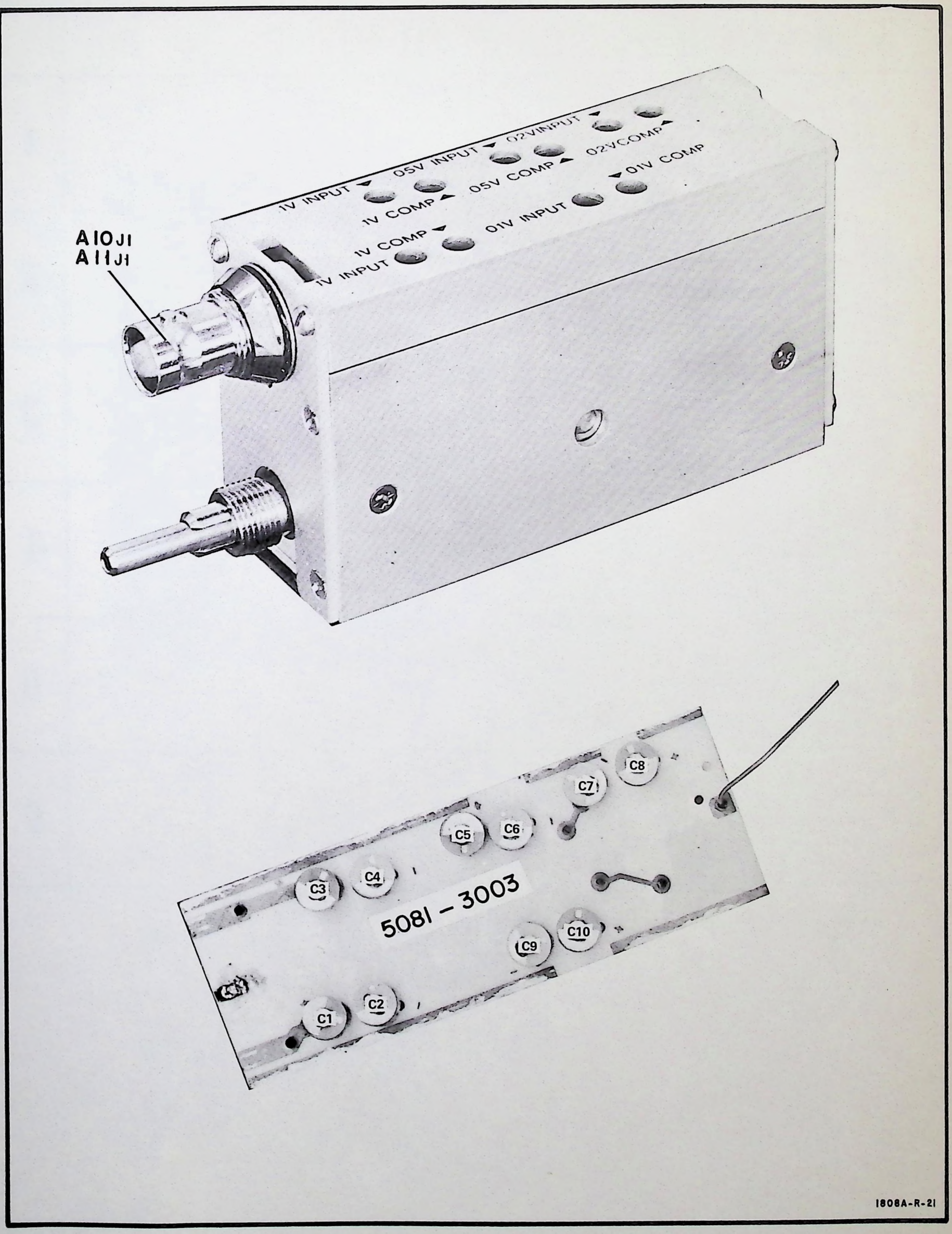
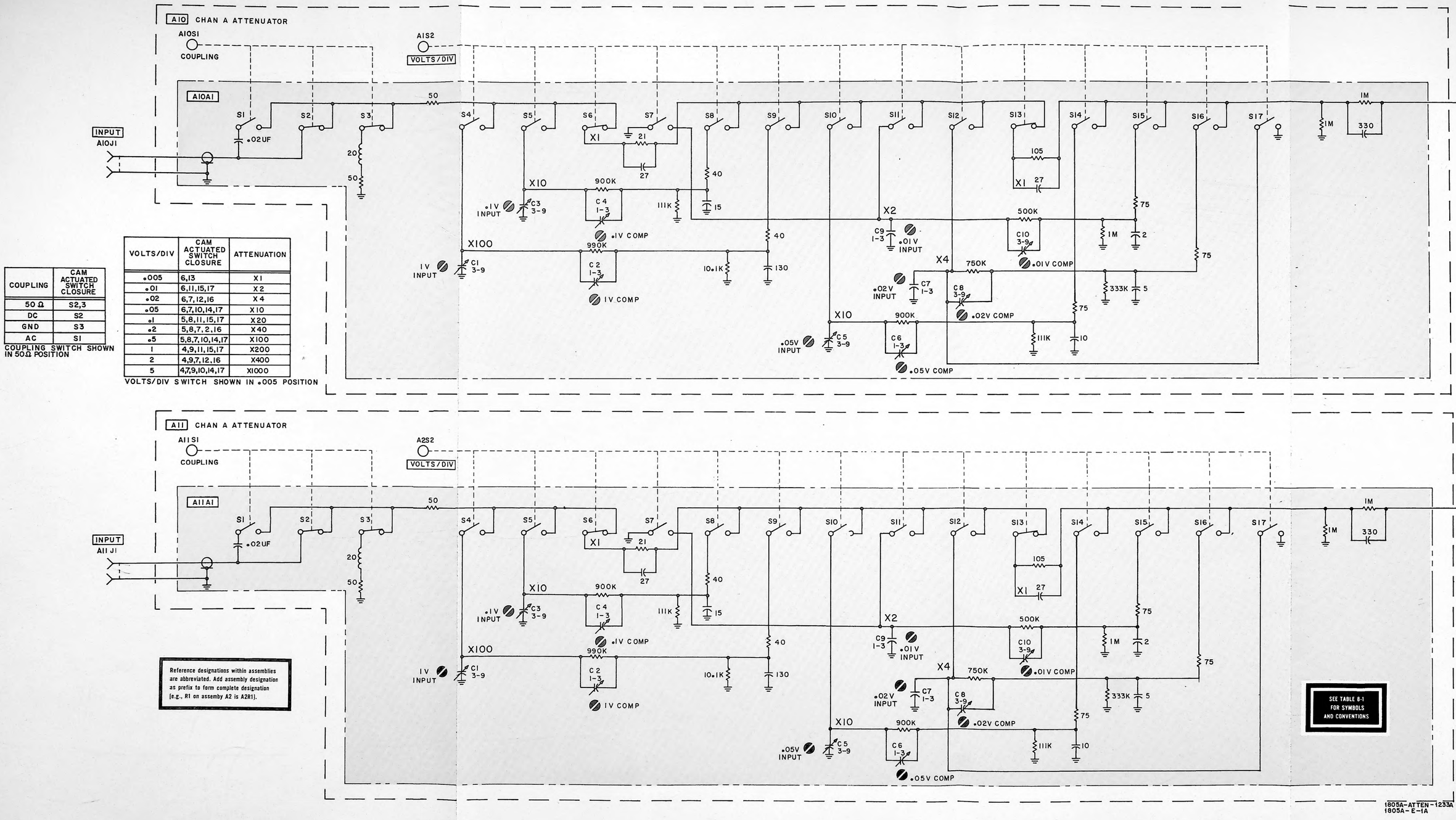


Figure 8-5. Attenuator Component Identification



COUPLING	CAM ACTUATED SWITCH CLOSURE
50 Ω	S2,3
DC	S2
GND	S3
AC	S1

COUPLING SWITCH SHOWN IN 50Ω POSITION

VOLTS/DIV	CAM ACTUATED SWITCH CLOSURE	ATTENUATION
.005	6,13	X1
.01	6,11,15,17	X2
.02	6,7,12,16	X4
.05	6,7,10,14,17	X10
.1	5,8,11,15,17	X20
.2	5,8,7,2,16	X40
.5	5,8,7,10,14,17	X100
1	4,9,11,15,17	X200
2	4,9,7,12,16	X400
5	4,7,9,10,14,17	X1000

VOLTS/DIV SWITCH SHOWN IN .005 POSITION

Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation [e.g., R1 on assemby A2 is A2R1].

SEE TABLE 8-1 FOR SYMBOLS AND CONVENTIONS

A10	A1
J1 S1,2	C1-S1,1
A11	A1
J1 S1,2	C1-S1,1

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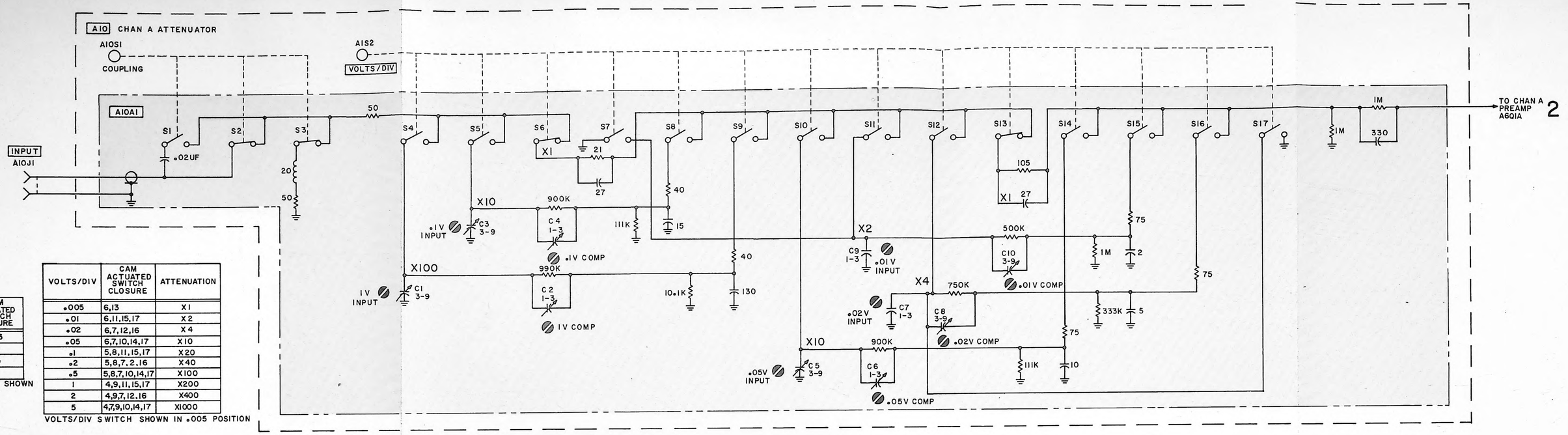
1805A-ATTEN-1233A
1805A-E-1A

Figu
Attenuator Sche

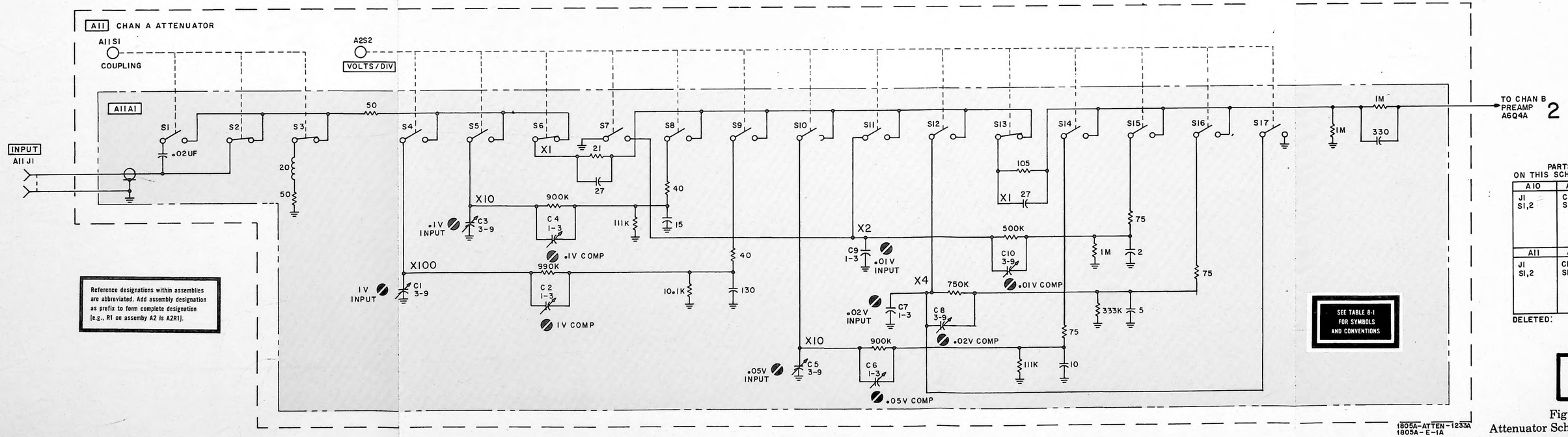


VOLTS/DIV	CAM ACTUATED SWITCH CLOSURE	ATTENUATION
.005	6,13	X1
.01	6,11,15,17	X2
.02	6,7,12,16	X4
.05	6,7,10,14,17	X10
.1	5,8,11,15,17	X20
.2	5,8,7.2.16	X40
.5	5,8,7,10,14,17	X100
1	4,9,11,15,17	X200
2	4,9,7,12.16	X400
5	4,7,9,10,14,17	X1000

VOLTS/DIV SWITCH SHOWN IN .005 POSITION

CAM ACTUATED SWITCH CLOSURE
S2,3
S2
S3
S1

WITCH SHOWN ON



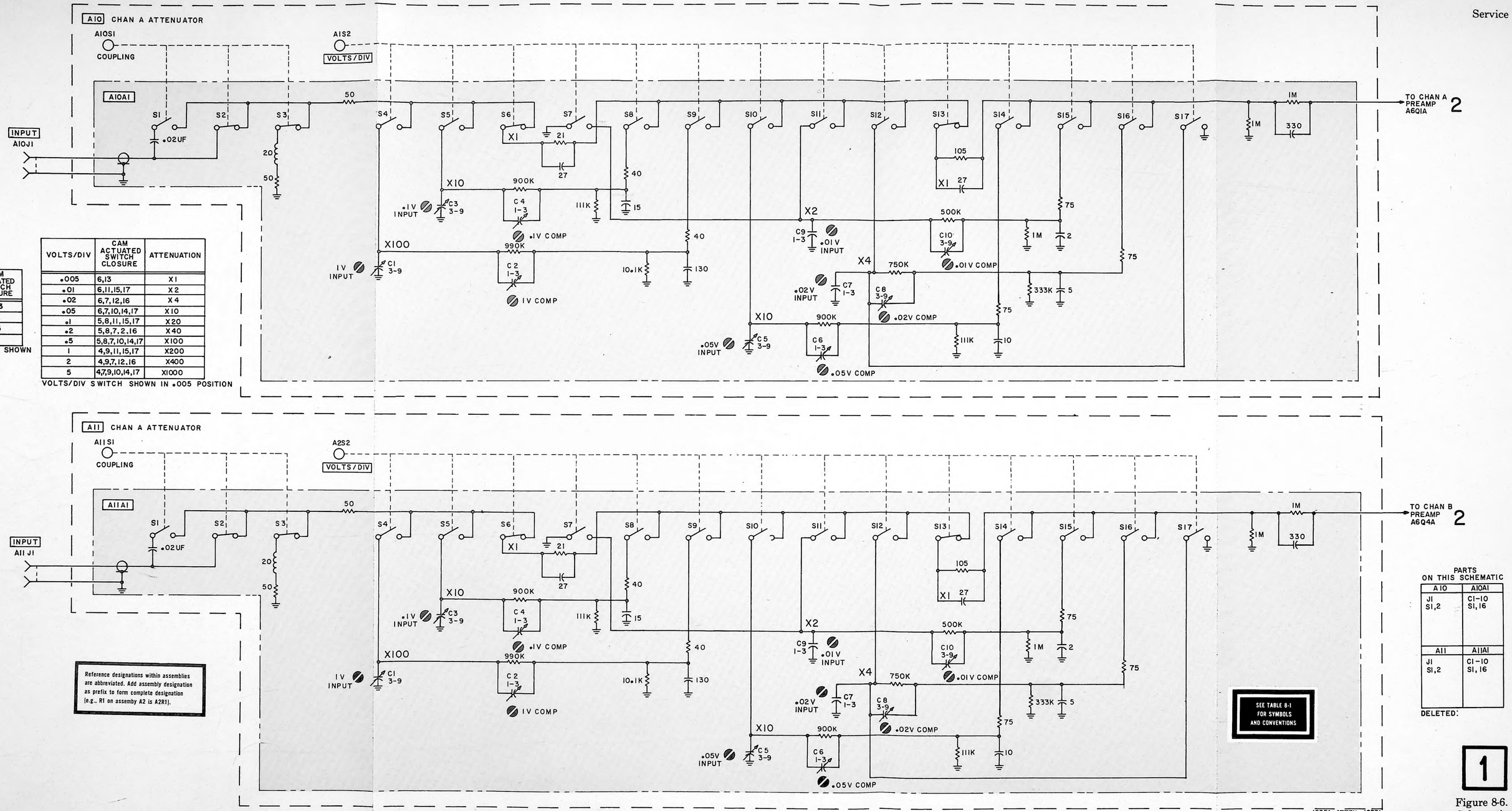
PARTS ON THIS SCHEMATIC

A10	A10A1
J1 S1,2	C1-10 S1,16
A11	**A11A1**
J1 S1,2	C1-10 S1,16

DELETED:

1

Figure 8-6.
Attenuator Schematic



COUPLING	CAM ACTUATED SWITCH CLOSURE
50 Ω	S2,3
DC	S2
GND	S3
AC	S1

COUPLING SWITCH SHOWN IN 50Ω POSITION

VOLTS/DIV	CAM ACTUATED SWITCH CLOSURE	ATTENUATION
.005	6,13	X1
.01	6,11,15,17	X2
.02	6,7,12,16	X4
.05	6,7,10,14,17	X10
.1	5,8,11,15,17	X20
.2	5,8,7,2,16	X40
.5	5,8,7,10,14,17	X100
1	4,9,11,15,17	X200
2	4,9,7,12,16	X400
5	4,7,9,10,14,17	X1000

VOLTS/DIV SWITCH SHOWN IN .005 POSITION

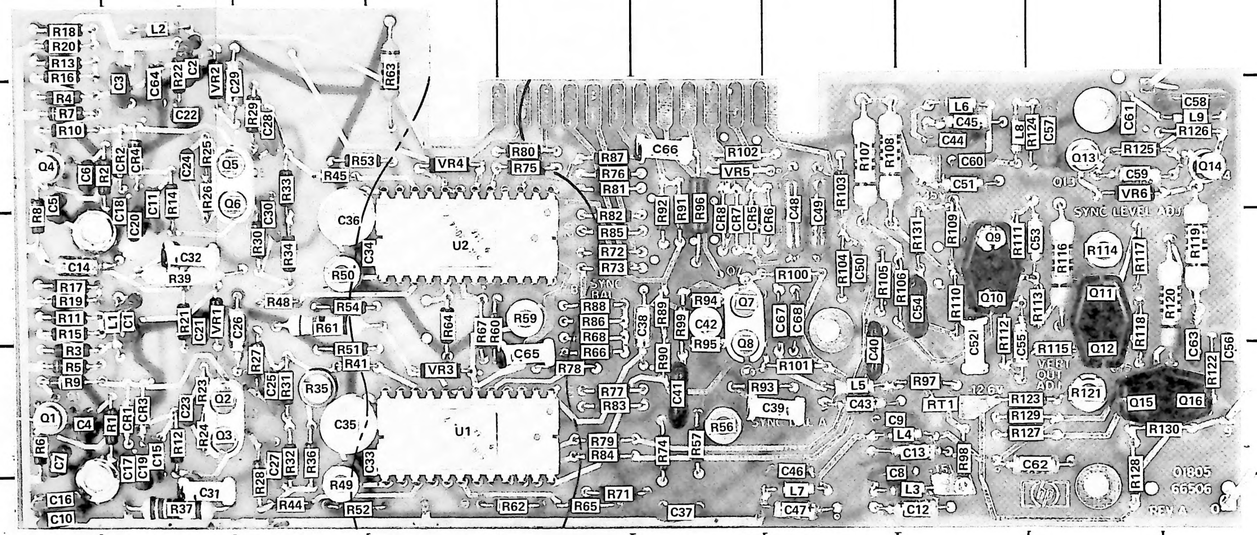
PARTS ON THIS SCHEMATIC

A10	A10A1
J1	C1-10
S1,2	S1,16
A11	**A11A1**
J1	C1-10
S1,2	S1,16

DELETED:

1

Figure 8-6.
Attenuator Schematic

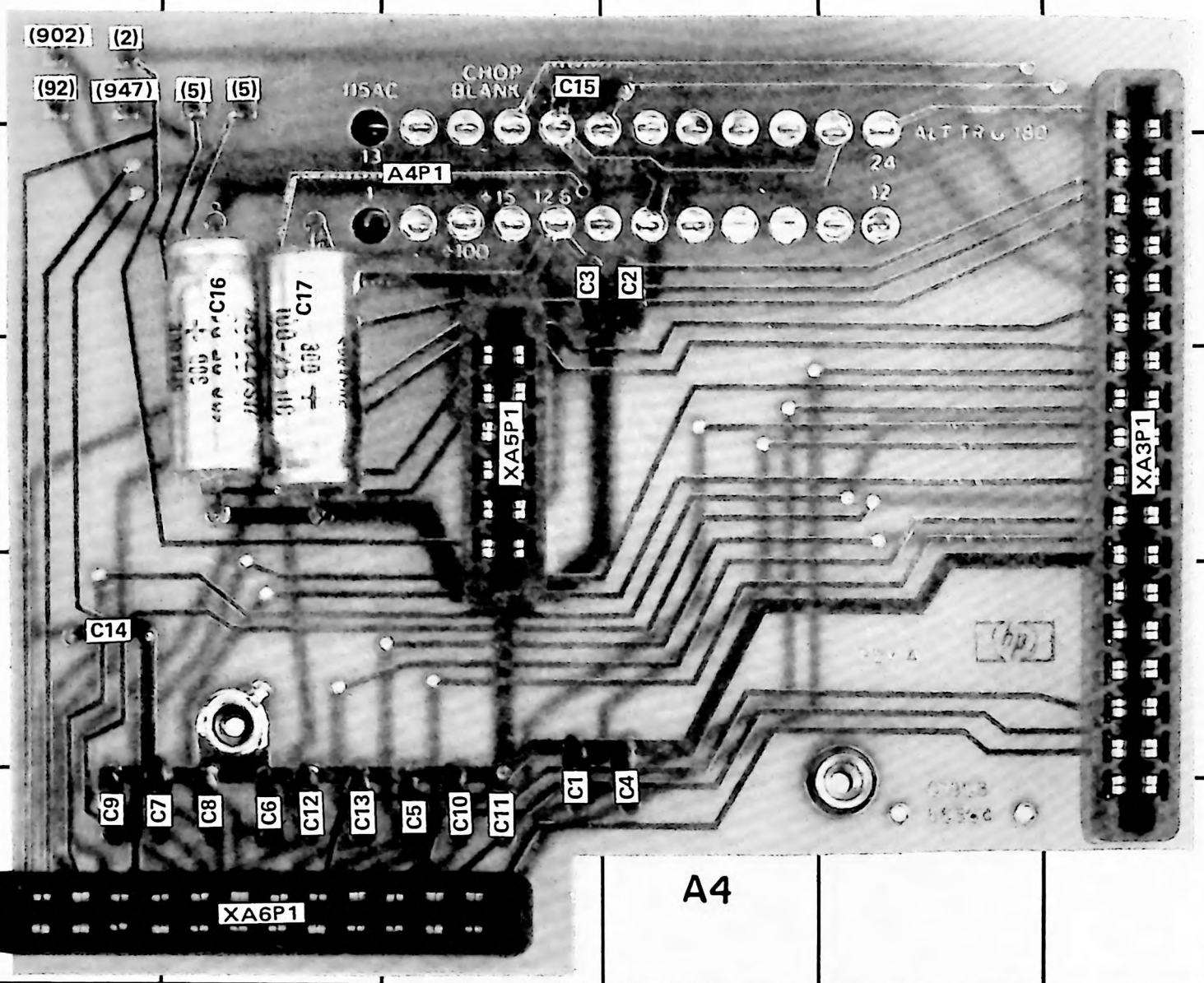


REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-3	C17	B-4	C33	D-4	C49	G-3	C65	E-4	L5	G-5	Q12	I-4	R12	B-4
C2	B-1	C18	B-2	C34	C-3	C50	G-3	C66	F-2	L6	H-2	Q13	I-2	R13	A-1
C3	B-2	C19	B-4	C35	C-4	C51	H-2	C67	G-3	L7	G-6	Q14	J-2	R14	B-2
C4	A-4	C20	B-3	C36	C-3	C52	H-4	C68	G-3	L8	H-2	Q15	I-4	R15	A-3
C5	A-2	C21	B-3	C37	F-5	C53	I-3	CR1	B-4	L9	J-2	Q16	J-4	R16	A-1
C6	A-2	C22	B-2	C38	F-3	C54	H-3	CR2	B-2	Q1	A-4	R1	B-4	R17	A-3
C7	A-4	C23	B-4	C39	G-4	C55	H-4	CR3	B-4	Q2	B-4	R2	B-2	R18	A-1
C8	G-4	C24	B-2	C40	G-5	C56	J-4	CR4	B-2	Q3	B-4	R3	A-4	R19	A-3
C9	G-4	C25	C-4	C41	I-4	C57	I-2	CR5	F-3	Q4	A-2	R4	A-2	R20	A-1
C10	A-5	C26	C-3	C42	F-3	C58	J-2	CR6	G-3	Q5	B-2	R5	A-4	R21	B-3
C11	B-2	C27	C-4	C43	G-5	C59	I-2	CR7	F-3	Q6	B-2	R6	A-4	R22	B-1
C12	H-5	C28	C-2	C44	H-2	C60	H-2	CR8	F-3	Q7	F-3	R7	A-2	R23	B-4
C13	H-4	C29	C-1	C45	H-2	C61	I-2	L1	B-3	Q8	F-3	R8	A-3	R24	B-4
C14	A-3	C30	C-3	C46	G-5	C62	I-4	L2	R-1	Q9	H-3	R9	A-4	R25	B-2
C15	B-4	C31	B-5	C47	G-6	C63	J-4	L3	H-5	Q10	H-3	R10	A-2	R26	B-2
C16	A-5	C32	B-3	C48	G-2	C64	B-2	L4	H-4	Q11	I-3	R11	A-3	R27	C-4

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
R28	C-5	R44	C-5	R60	D-3	R76	E-2	R92	F-2	R108	G-2	R124	I-2		
R29	C-2	R45	C-2	R61	C-3	R77	F-4	R93	F-4	R109	H-3	R125	I-2		
R30	C-3	R46	L-3	R62	E-5	R78	E-4	R94	F-3	R110	H-3	R126	J-2		
R31	C-4	R47	L-3	R63	D-1	R79	E-4	R95	F-4	R111	H-3	R127	H-4		
R32	C-4	R48	C-3	R64	D-3	R80	E-2	R96	F-2	R112	H-5	R128	I-4		
R33	C-2	R49	C-5	R65	E-5	R81	E-2	R97	H-4	R113	I-3	R129	H-4		
R34	C-3	R50	C-3	R66	E-4	R82	E-3	R98	H-4	R114	I-3	R130	J-4		
R35	C-4	R51	C-4	R67	D-3	R83	E-4	R99	F-3	R115	I-4	R131	H-2		
R36	C-4	R52	C-5	R68	E-3	R84	E-4	R100	G-3	R116	I-3	RT1	H-4		
R37	B-5	R53	C-2	R69	L-4	R85	E-3	R101	G-5	R117	I-3	U1	D-4		
R38	L-4	R54	C-3	R70	L-3	R86	E-3	R102	F-2	R118	I-3	U2	D-3		
R39	B-3	R55	L-4	R71	E-5	R87	E-2	R103	G-2	R119	J-3	VR1	B-3		
R40	L-3	R56	F-4	R72	E-3	R88	E-3	R104	G-3	R120	J-3	VR2	B-2		
R41	L-4	R57	F-4	R73	E-3	R89	F-3	R105	G-3	R121	I-4	VR3	D-4		
R42	L-4	R58	L-3	R74	F-4	R90	F-4	R106	H-3	R122	J-4	VR4	D-2		
R43	L-4	R59	E-3	R75	E-2	R91	F-2	R107	G-2	R123	H-4	VR5	F-2		
												VR6	I-2		

1605A-R-9

Figure 8-7. Preamplifier and Sync Amplifier A6, Component Identification



A4

Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-5	C6	B-5	C12	B-5
C2	D-2	C7	A-5	C13	B-5
C3	C-2	C8	B-5	C14	A-4
C4	D-5	C9	A-5	C15	C-2
C5	C-5	C10	C-5	C16	B-2
		C11	C-5	C17	B-2

1805A-R-15

Figure 8-8. Interconnecting Board A4, Component Identification

Table 8-3. Voltage Measurement Conditions

OSCILLOSCOPE

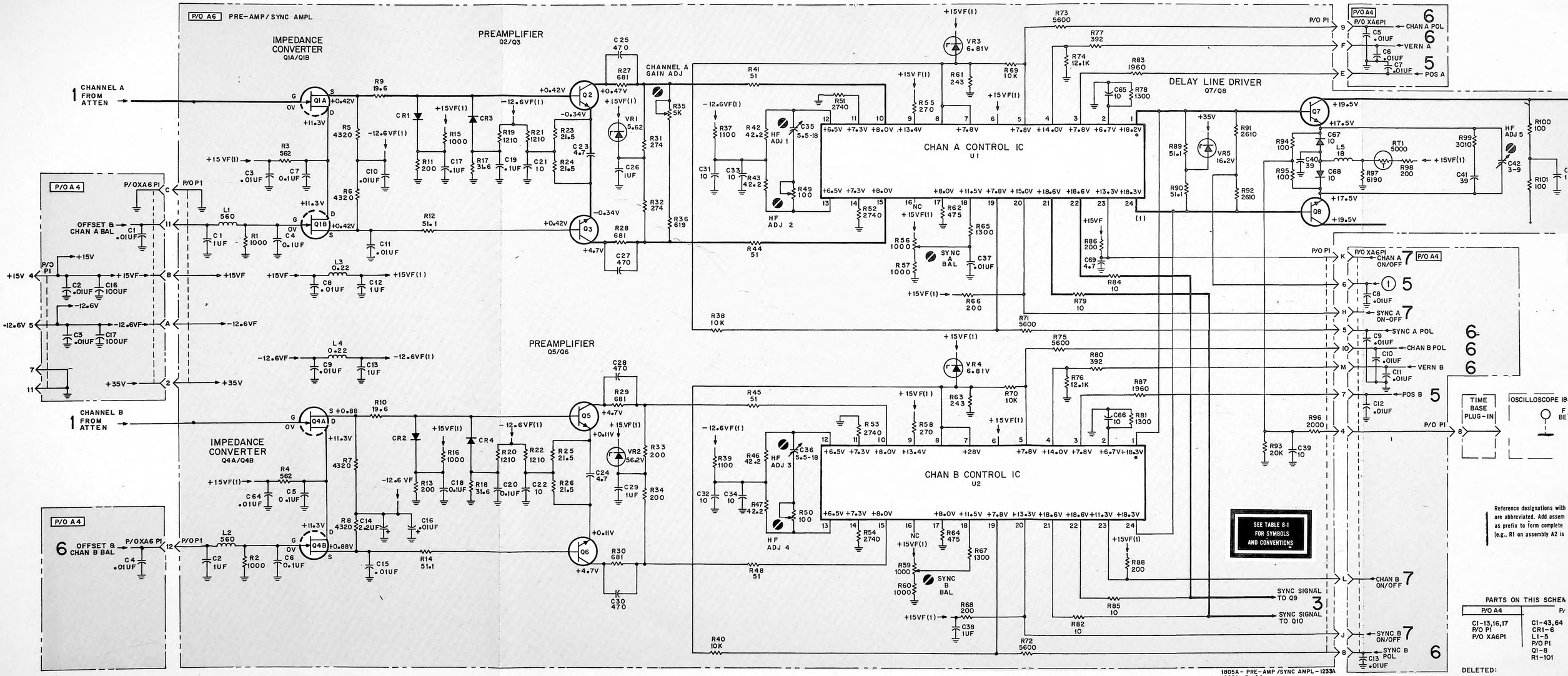
Focus	as necessary
Intensity	as necessary
Horizontal position	as necessary
Mag	X1
Display	Internal

TIME BASE

Time/division	0.5 m/sec
Trigger	Internal
Mode	Auto

MODEL 1805A

DISPLAY	A
TRIG SOURCE	A
Polarity	+ UP
VOLTS/DIV	.005
VERNIER	CAL
POSITION	as necessary
Coupling	GND



Preamplifier and Sync

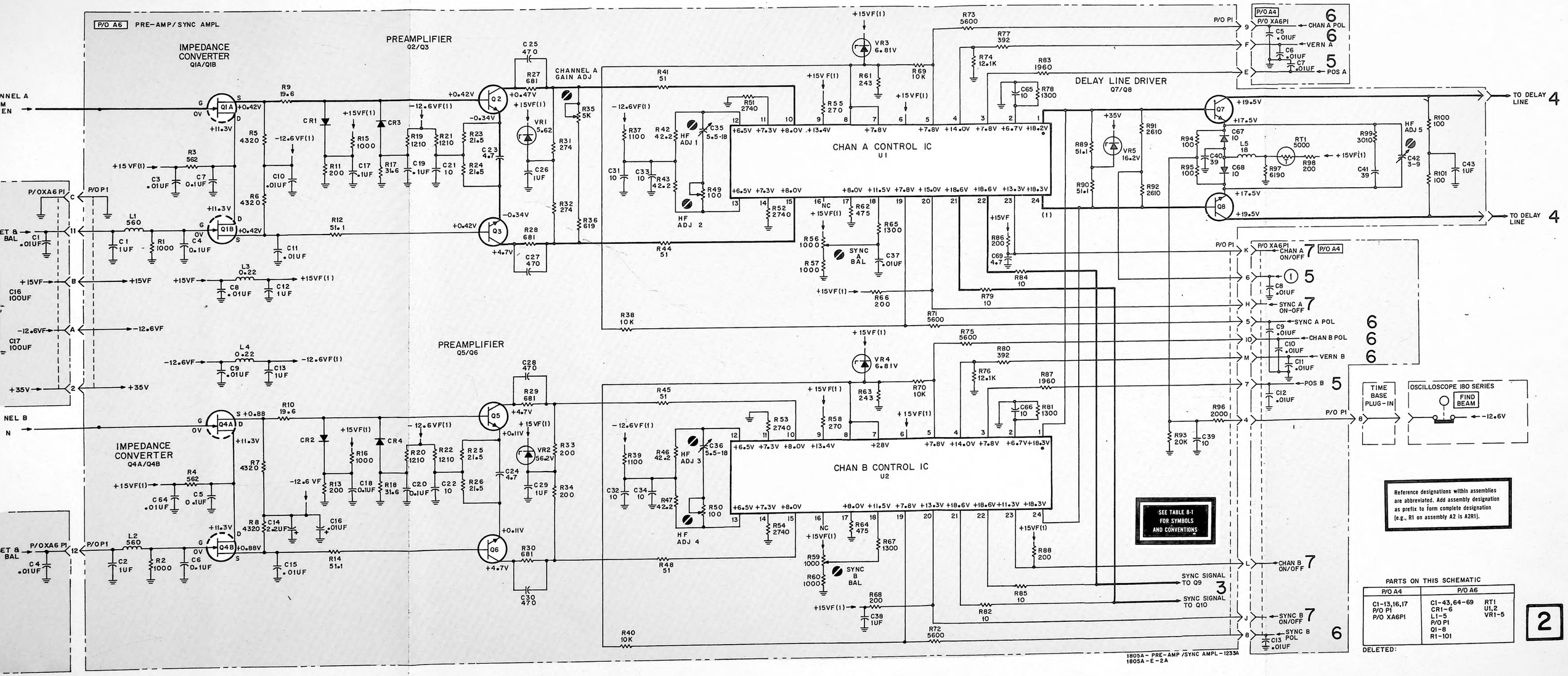


Figure 8-9.
Preamplifier and Sync Amplifier Schematic
8-13 / 8-14

Table 8-4. Voltage Measurement Conditions

OSCILLOSCOPE

Focus	as necessary
Intensity	as necessary
Horizontal position	as necessary
Mag	X1
Display	Internal

TIME BASE

Time/division	0.5 m/sec
Trigger	Internal
Mode	Auto

MODEL 1805A

DISPLAY	A
TRIG SOURCE	A
Polarity	+ UP
VOLTS/DIV	.005
VERNIER	CAL
POSITION	as necessary
Coupling	GND

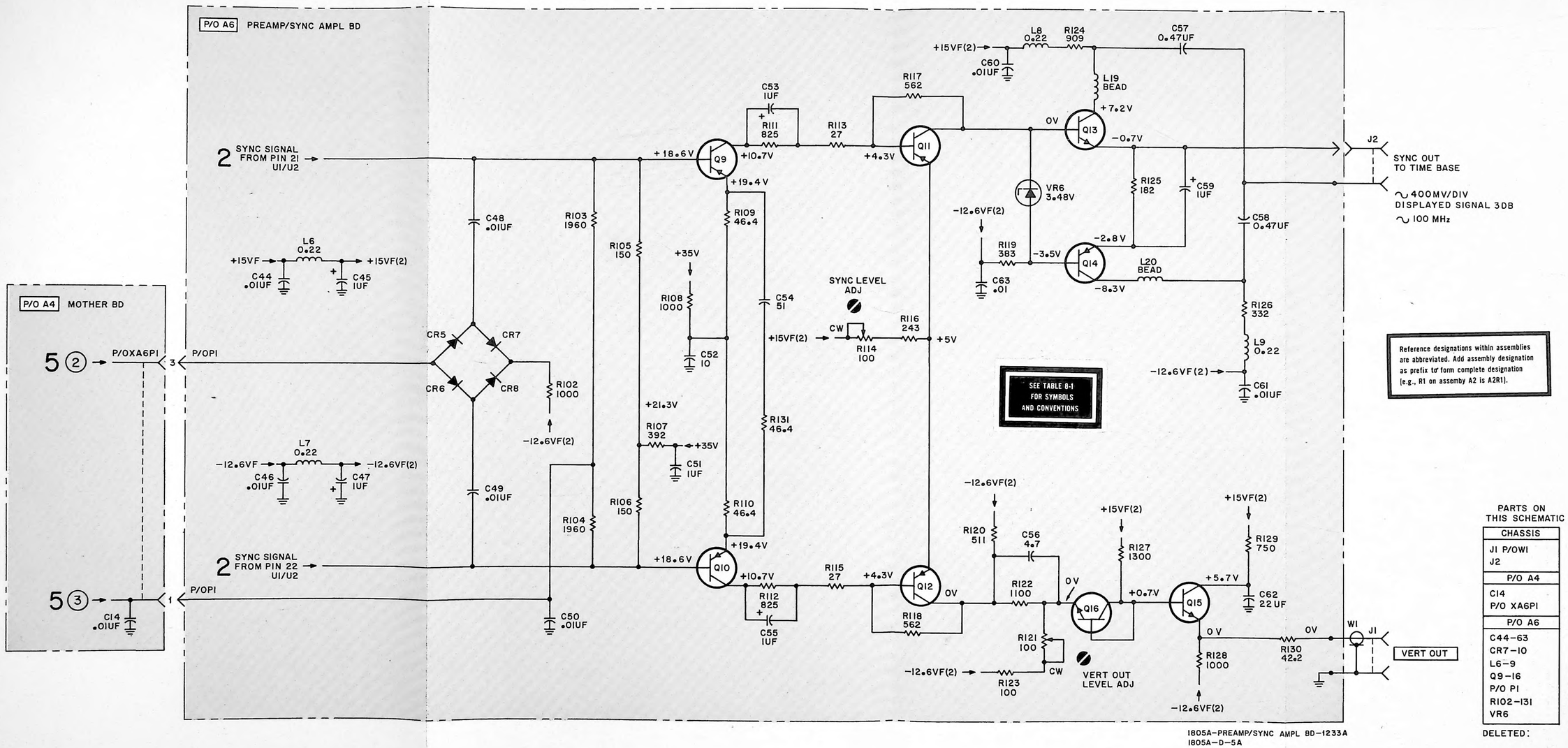
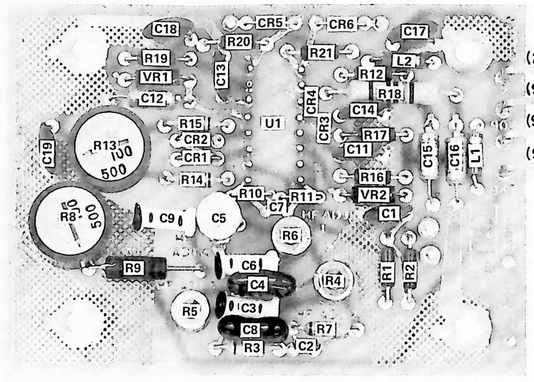


Figure 8-10.
Preamplifier and Sync Amplifier Schematic

	A	B	C	D	E	F	
1							1
2							2
3							3
4							4
5				A7			5
6	Circuit boards have plated through component holes. This permits soldering from either side of the board.						6



(2)+35V
(902)+15V
(902) TO RI
(947) TO CAL

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	C9	C-3	C18	C-2	L1	E-3	R8	B-3	R17	D-3
C2	D-4	C11	D-3	C19	B-3	L2	D-2	R9	B-4	R18	D-2
C3	C-4	C12	C-3	CR1	C-3	R1	D-4	R10	C-3	R19	C-2
C4	C-4	C13	C-2	CR2	C-3	R2	E-4	R11	D-3	R20	C-2
C5	C-3	C14	D-3	CR3	D-3	R3	C-4	R12	D-2	R21	D-2
C6	C-4	C15	E-3	CR4	D-3	R4	D-4	R13	B-3	VR1	C-2
C7	D-3	C16	E-3	CR5	C-2	R5	C-4	R14	C-3	VR2	D-3
C8	C-4	C17	E-2	CR6	D-2	R6	D-4	R15	C-3	U1	C-3
						R7	D-4	R16	D-3		

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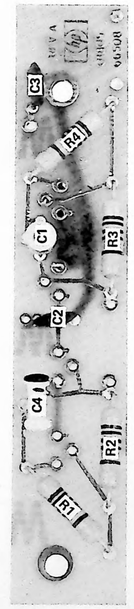
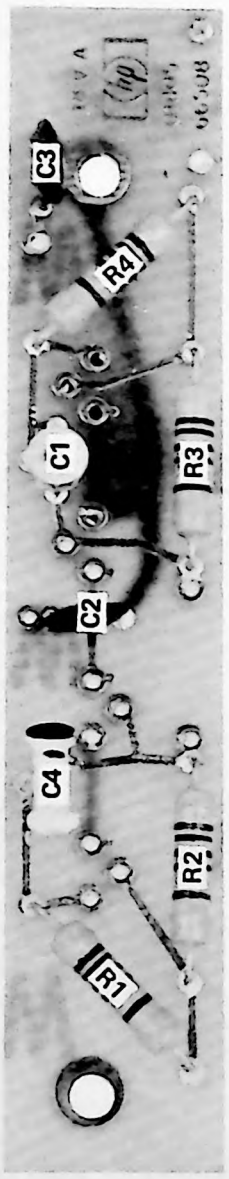
Figure 8-11. Main Amplifier Board A7, Component Identification



A8

Figure 8-12. Output Amplifier A8, Component Identifica



A8

1805A-R-10

Figure 8-12. Output Amplifier A8, Component Identification

Table 8-5. Voltage Measurement Conditions

OSCILLOSCOPE

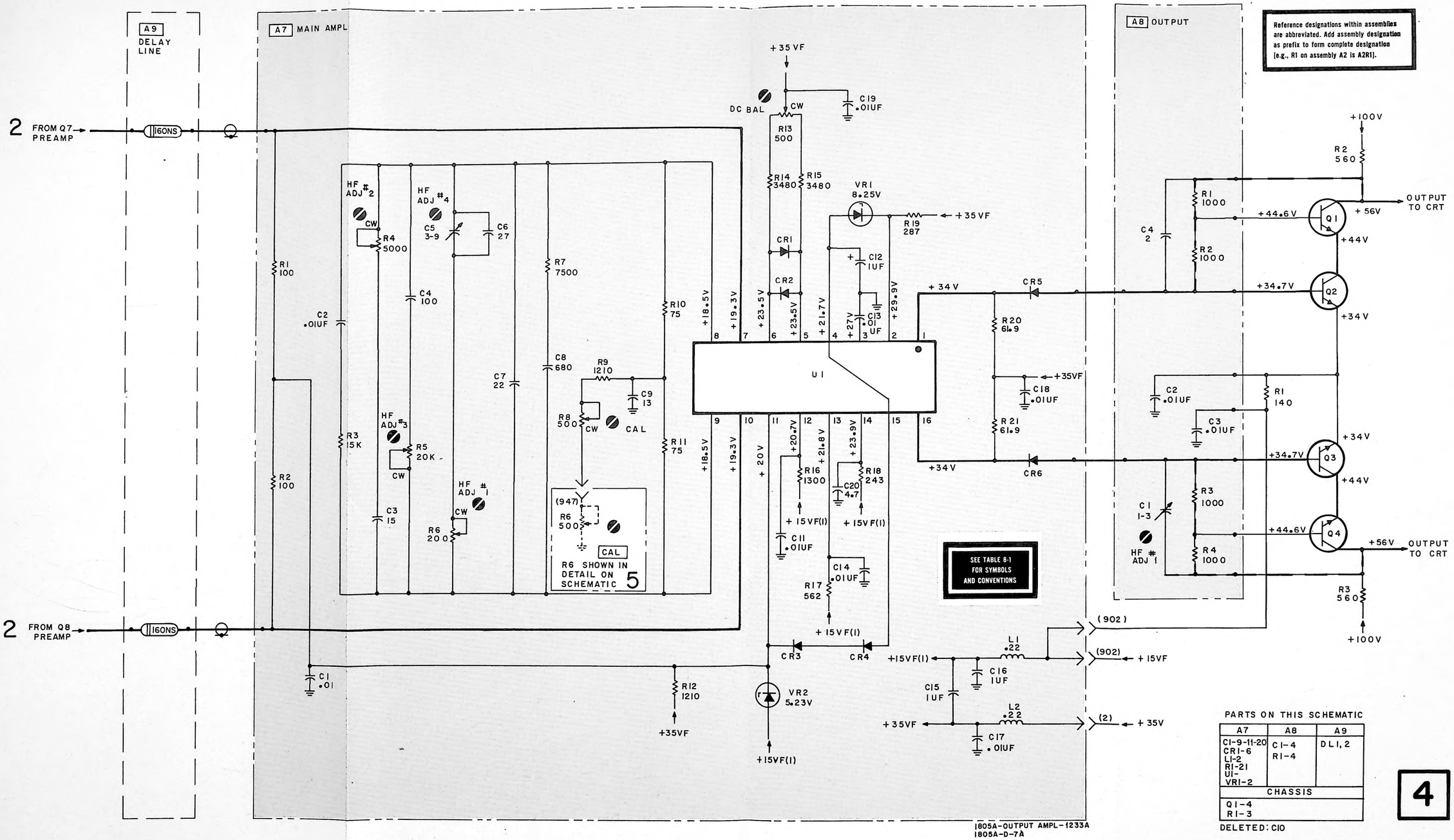
Focus	as necessary
Intensity	as necessary
Horizontal position	as necessary
Mag	X1
Display	Internal

TIME BASE

Time/division	0.5 m/sec
Trigger	Internal
Mode	Auto

MODEL 1805A

DISPLAY	A
TRIG SOURCE	A
Polarity	+ UP
VOLTS/DIV	.005
VERNIER	CAL
POSITION	as necessary
Coupling	GND



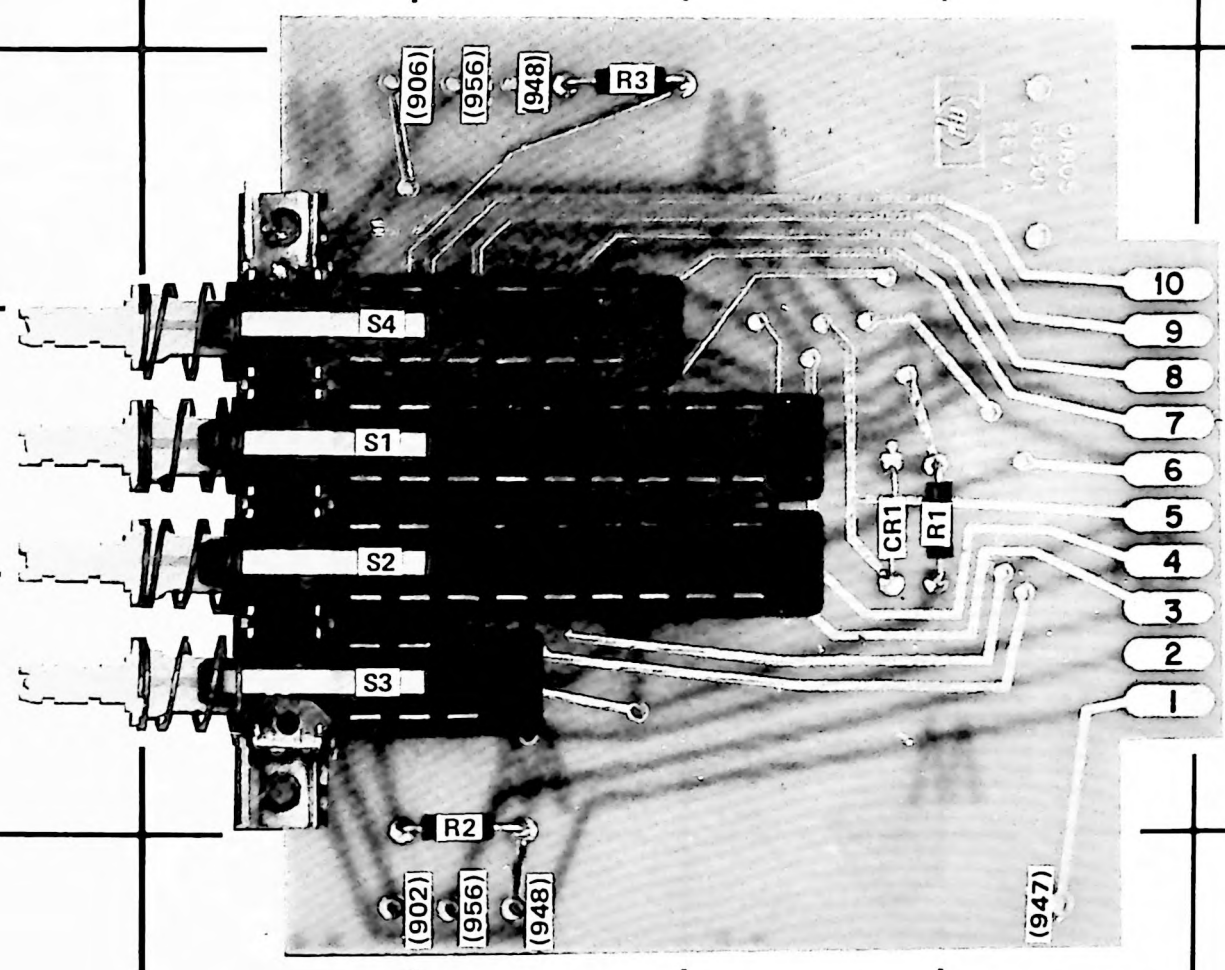
PARTS ON THIS SCHEMATIC

A7	A8	A9
C1-9-11-20 CR1-6 L1-2 R1-21 U1- VR1-2	C1-4 R1-4	D L1, 2
CHASSIS		
Q1-4 R1-3		

DELETED: C10

4

Figure 8-13.
Output Amplifier Schematic



Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC
CR1	D-3	S1	B-3
R1	D-3	S2	B-3
R2	C-4	S3	B-4
R3	C-2	S4	B-3

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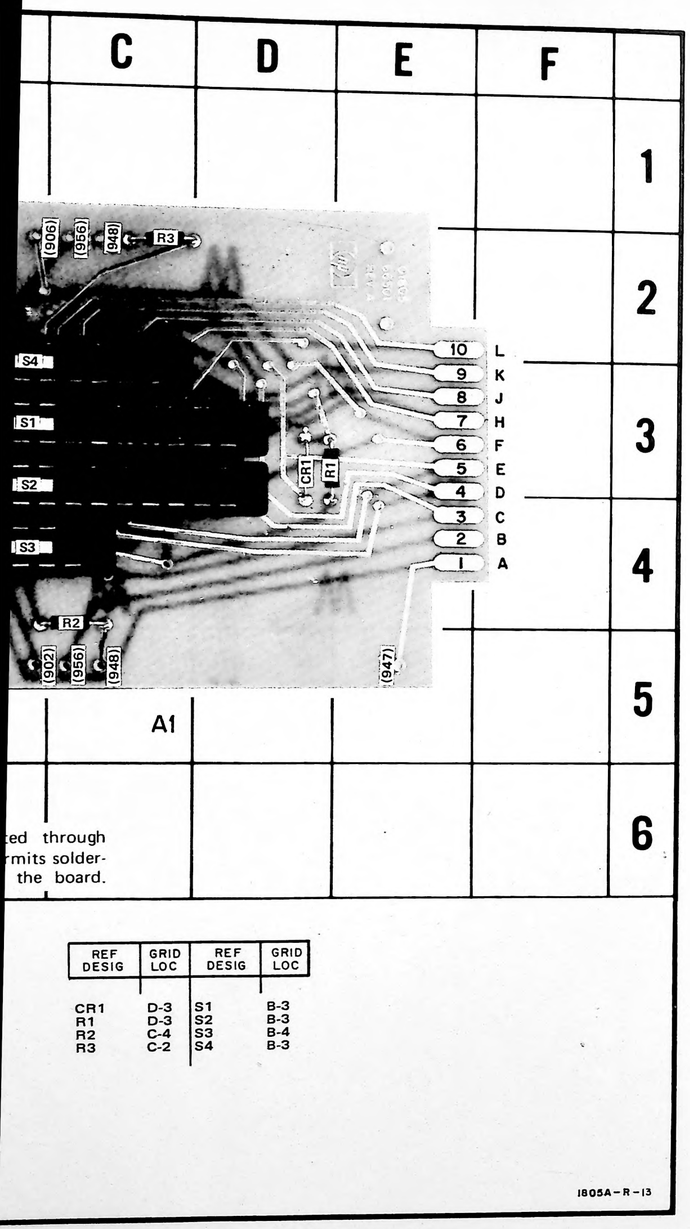
Figure 8-14. Top Switch Board A1, Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC
CR1	D-3	S1	B-3
R1	D-3	S2	B-3
R2	C-4	S3	B-4
R3	C-2	S4	B-3

-14. Top Switch Board A1, Component Identification

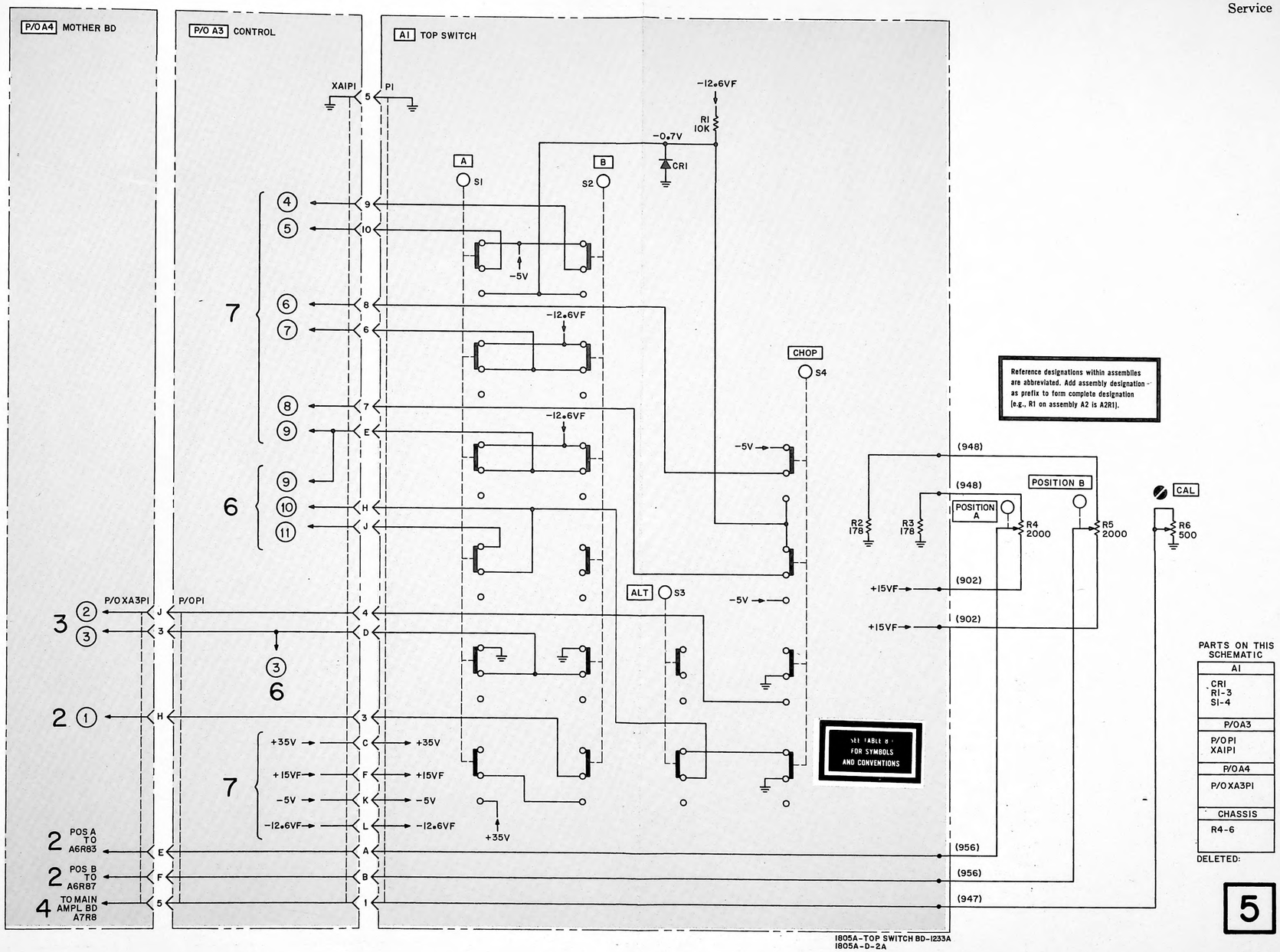
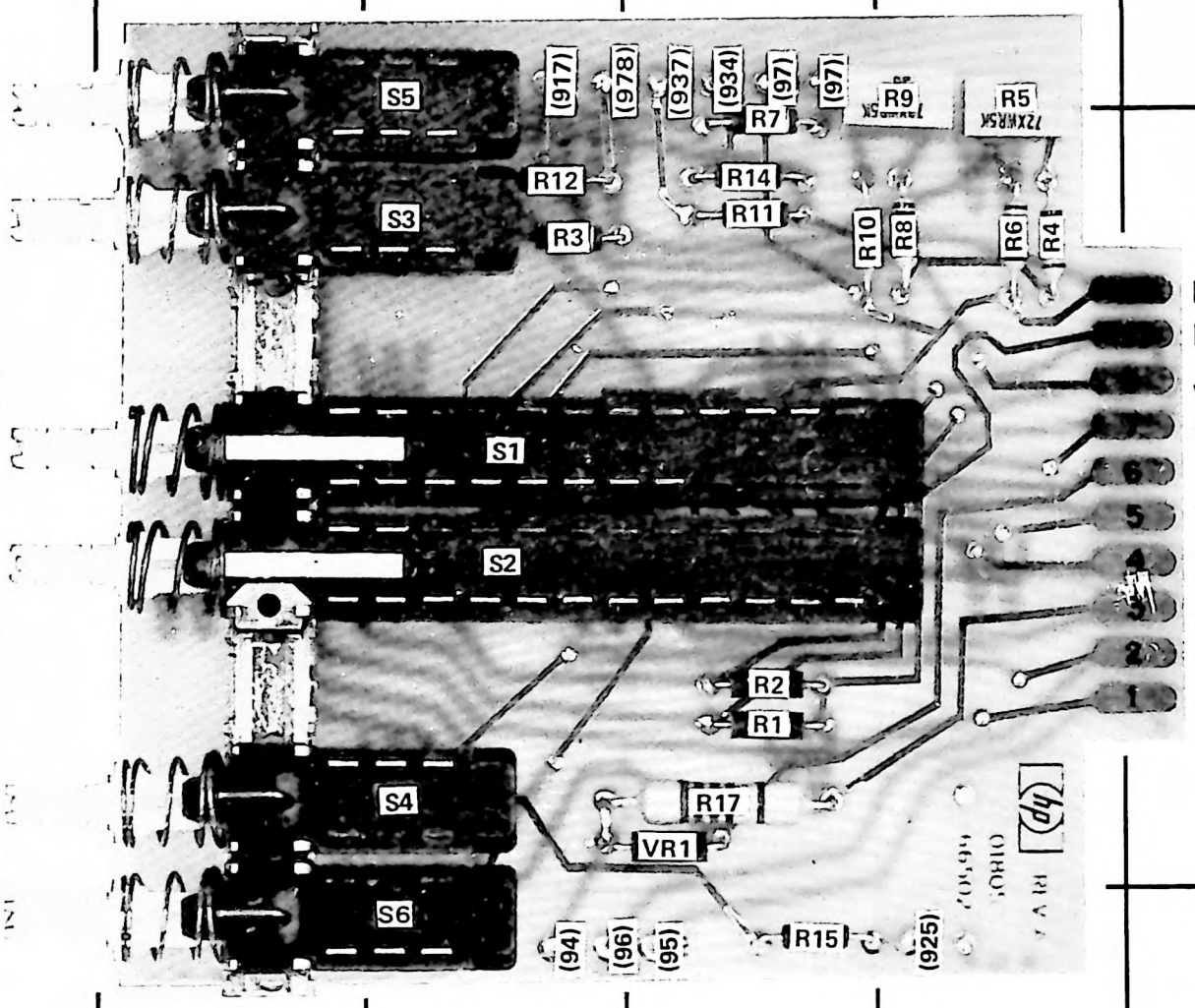


Figure 8-15.
Top Switch Board Schematic



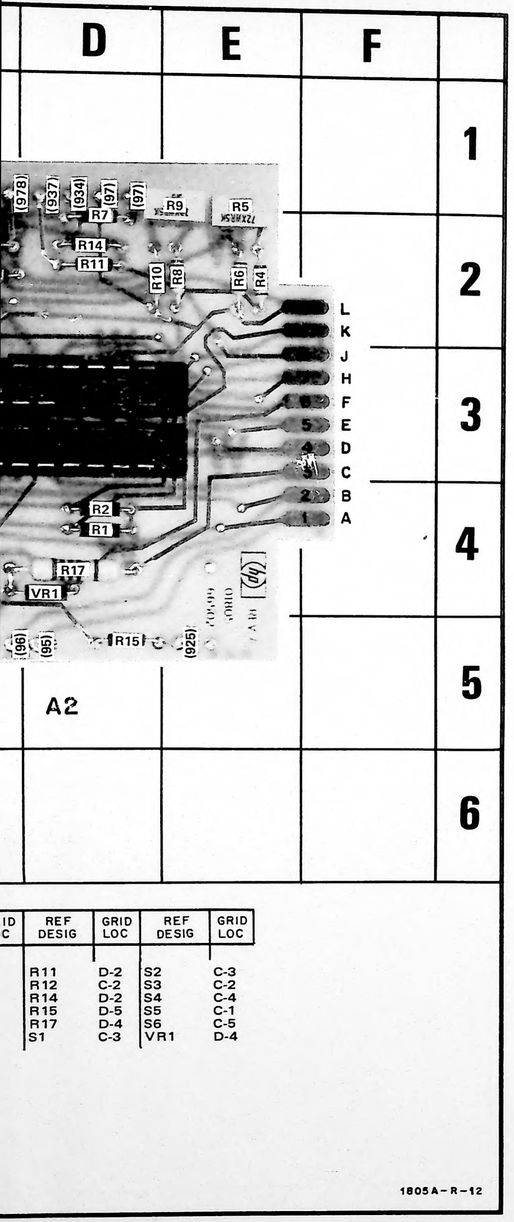
A2

Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
R1	D-4	R6	E-2	R11	D-2	S2	C-3
R2	D-4	R7	D-2	R12	C-2	S3	C-2
R3	C-2	R8	E-2	R14	D-2	S4	C-4
R4	E-2	R9	E-1	R15	D-5	S5	C-1
R5	E-1	R10	D-2	R17	D-4	S6	C-5
				S1	C-3	VR1	D-4

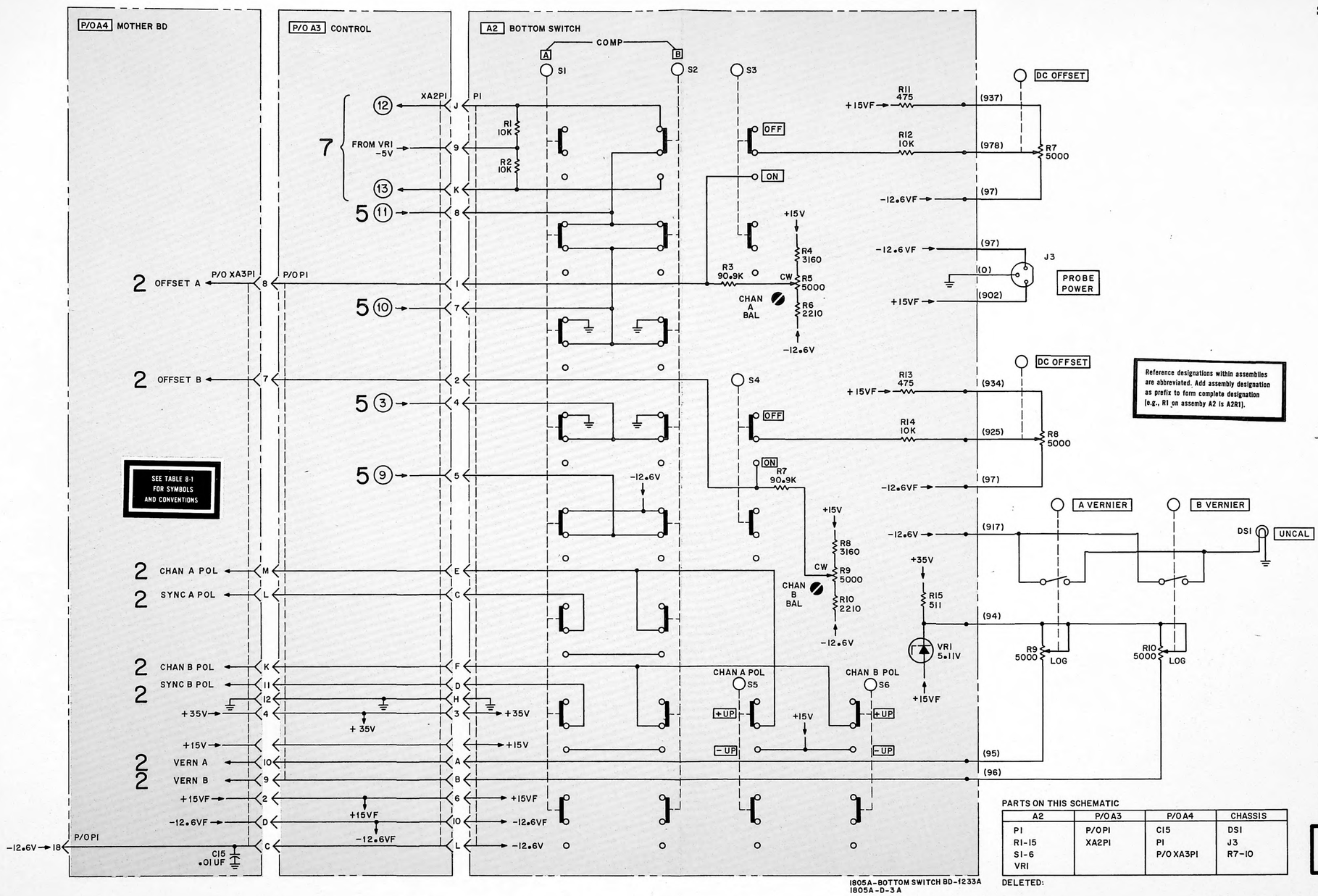
1805A-R-12

Figure 8-16. Bottom Switch Board A2, Component Identification



ID C	REF DESIG	GRID LOC	REF DESIG	GRID LOC
	R11	D-2	S2	C-3
	R12	C-2	S3	C-2
	R14	D-2	S4	C-4
	R15	D-5	S5	C-1
	R17	D-4	S6	C-5
	S1	C-3	VR1	D-4

oard A2, Component Identification



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

PARTS ON THIS SCHEMATIC

A2	P/O A3	P/O A4	CHASSIS
P1	P/O P1	C15	DS1
R1-15	XA2P1	P1	J3
S1-6		P/O XA3P1	R7-10
VR1			

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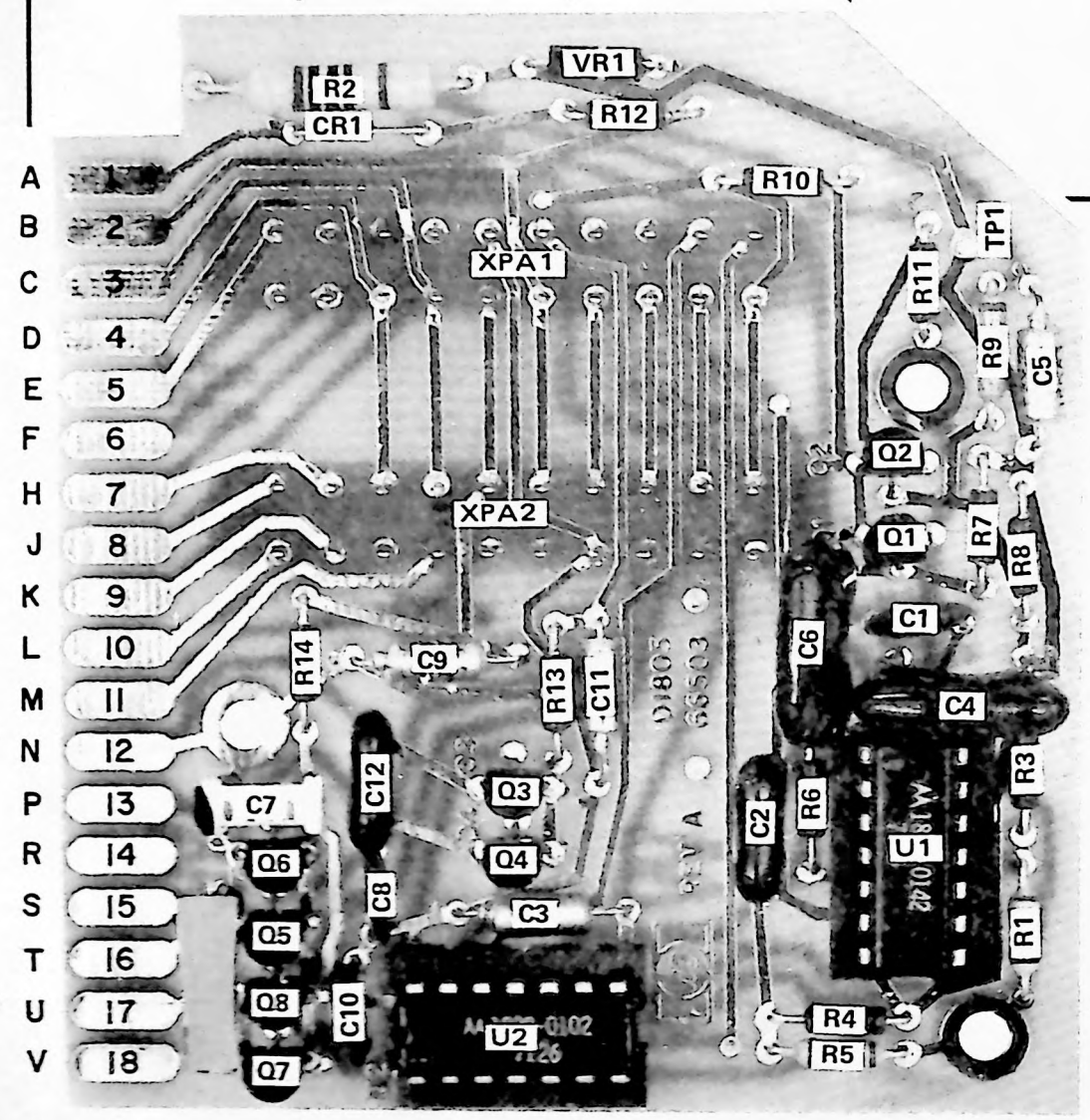
6

Figure 8-17.
Bottom Switch Board Schematic
8-21



Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	C11	D-3	Q8	B-5	R10	D-1
C2	D-4	C12	C-4	R1	E-4	R11	E-2
C3	C-4	CR1	C-1	R2	C-1	R12	D-1
C4	E-3	Q1	E-3	R3	E-4	R13	C-3
C5	E-2	Q2	E-3	R4	D-5	R14	B-3
C6	D-3	Q3	C-4	R5	D-5	U1	E-4
C7	B-4	Q4	C-4	R6	D-4	U2	C-5
C8	C-4	Q5	B-4	R7	E-3	VR	D-1
C9	C-3	Q6	B-4	R8	E-3	XPA1	C-2
C10	C-5	Q7	B-5	R9	E-2	XPA2	C-3

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Figure 8-18. Control Board A3, Component Identification

Table 8-6. Voltage Measurement Conditions

OSCILLOSCOPE

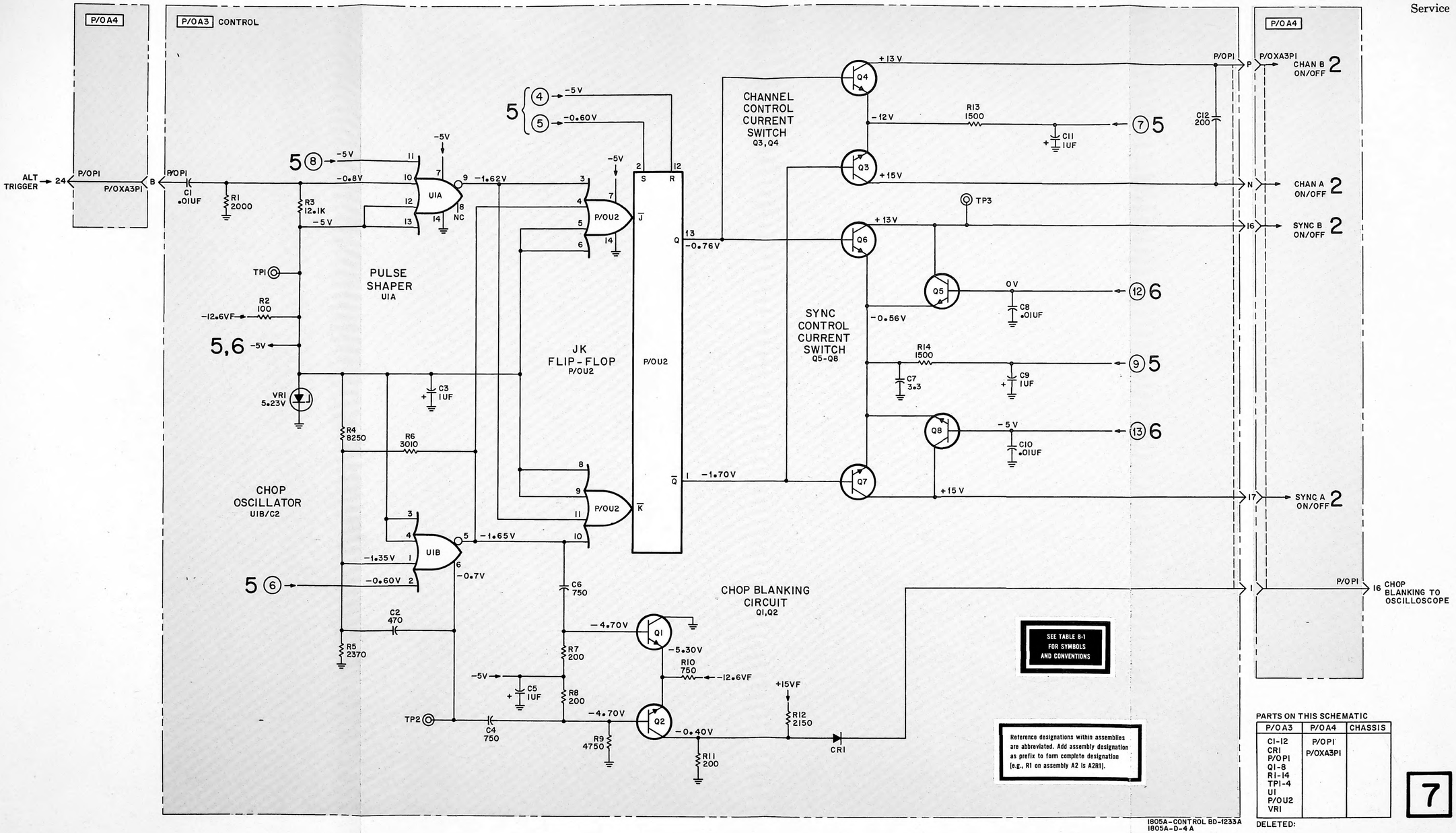
Focus	as necessary
Intensity	as necessary
Horizontal position	as necessary
Mag	X1
Display	Internal

TIME BASE

Time/division	0.5 m/sec
Trigger	Internal
Mode	Auto

MODEL 1805A

DISPLAY	A
TRIG SOURCE	A
Polarity	+ UP
VOLTS/DIV	.005
VERNIER	CAL
POSITION	as necessary
Coupling	GND



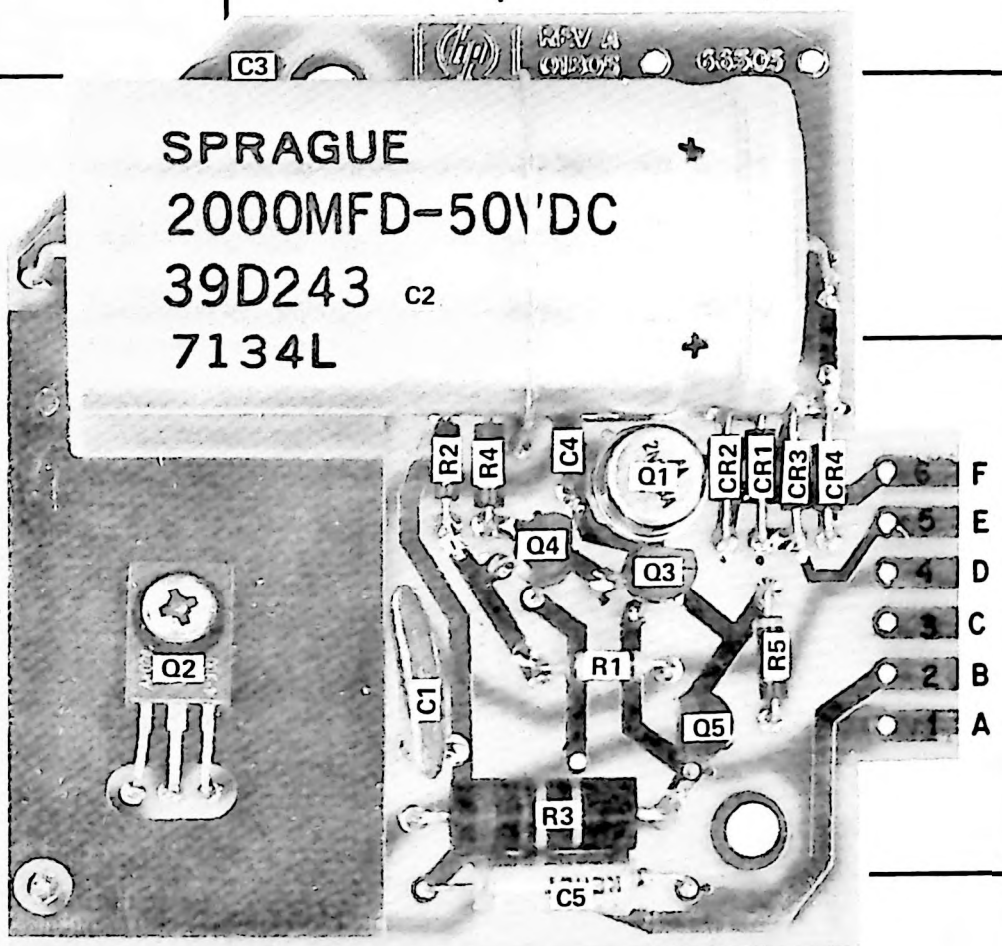
PARTS ON THIS SCHEMATIC

P/OA3	P/OA4	CHASSIS
C1-12 CR1 P/OP1 Q1-8 R1-14 TP1-4 U1 P/OU2 VR1	P/OP1 P/OXA3PI	

DELETED:

7

Figure 8-19.
Control Board Schematic
8-23 / 8-24



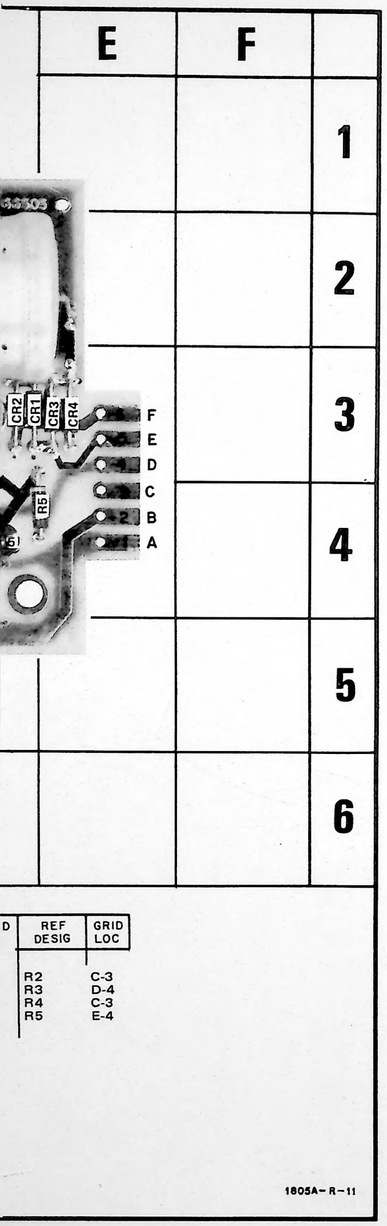
A5

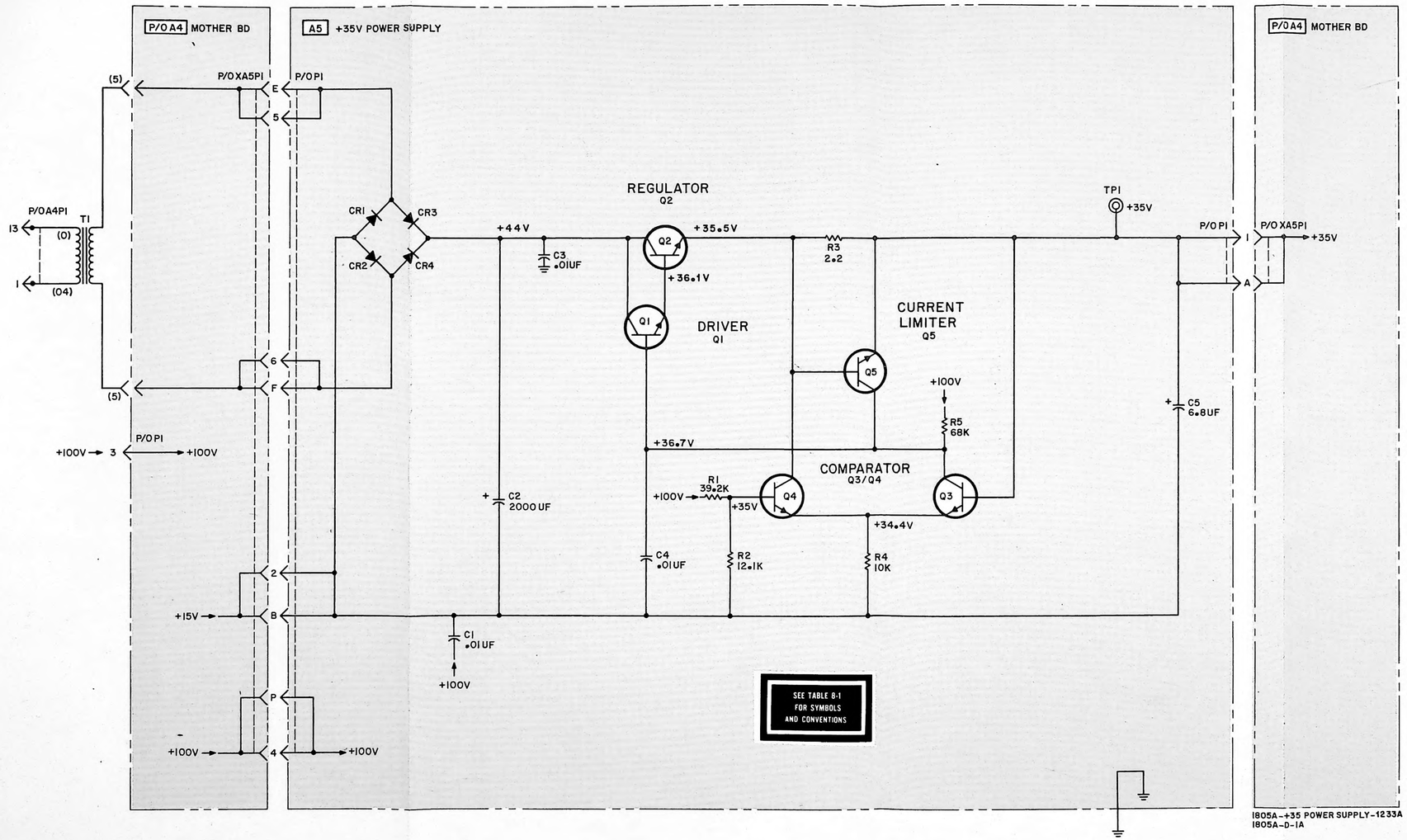
Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	CR1	D-3	Q2	B-4	R2	C-3
C2	C-2	CR2	D-3	Q3	D-3	R3	D-4
C3	C-1	CR3	E-3	Q4	D-3	R4	C-3
C4	D-3	CR4	E-3	Q5	D-4	R5	E-4
C5	D-5	Q1	D-3	R1	D-4		

1805A-R-11

Figure 8-20. Power Supply A5, Component Identification





t Identification

Figure 8-21.
Power Supply Schematic
8-25/ 8-26

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